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FRAMEWORK UNTUK MERANCANG PERSIAPAN KARYAWAN DEPARTEMEN PENELITIAN DAN PENGEMBANGAN PADA PT. SEMEN INDONESIA TBK DENGAN *INSTRUCTIONAL SYSTEM DESIGN* DAN *ANALYTICAL HIERARCHY PROCESS*

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FINAL PROJECT – TI 141501

A FRAMEWORK FOR DESIGNING RESEARCH & DEVELOPMENT DEPARTMENT EMPLOYEE PREPARATION IN PT. SEMEN INDONESIA TBK USING ISD AND AHP

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ABSTRAK

ASEAN Economic Community (AEC) atau Masyarakat Ekonomi ASEAN (MEA) yang diberlakukan pada tahun 2016, tentunya memiliki dampak besar seperti pada perusahaan akan terjadi persaingan antar perusahaan. Salah satu perusahaan yang terkena dampak ini adalah Semen Indonesia yang mana menguasai kapasitas produksi semen dengan produksi lebih dari 29 juta ton semen atau setara dengan 41.2% total konsumsi semen di Indonesia. Jadi pernting untuk adanya pengembangan di bidang inovasi untuk bisa berkompetisi diantara negara-negara ASEAN yang diperketat dengan isu ini. *Instructional System Design* (ISD) adalah salah satu metode yang dapat memberikan peningkatan kualitas karyawan melalui penyajian informasi mendalam mengenai jabatan tersebut. Pada kasus ini, metode *Instructional System Design* (ISD) di aplikasikan pada posisi Spesialis/Kepala Seksi dari department teknologi & produksi di PT. Semen Indonesia Tbk. Metode *Instructional System Design* (ISD) yang dikombinasikan dengan *Analytical Hierarchy Process* (AHP) akan memberikan informasi terkait dengan derajat kepentingan dari pengetahuan dan training inti manakan yang sangat dibutuhkan untuk dipelajari. Lalu pelatihan, isi dari pelatihan, dan modul yang sesuai dengan jabatan dianalisis menyesuaikan kebutuhan pengetahuan. Proses ini pada dasarnya dilakukan untuk menemukan kriteria dari pengetahuan yang dibutuhkan jabatan tersebut, sehingga pada saat pelatihan, efektifitas dari pengetahuan yang diserap menjadi maksimal, karena hanya pengetahuan yang diperlukan saja yang ditampilkan. Maka pemegang jabatan berikutnya dapat dengan siap menghadapi permasalahan teknologi dan dapat dengan efektif mengkoordinasikan dan melakukan penelitian untuk inovasi.

Kata Kunci: Semen, Inovasi, *Instructional System Design* (ISD), *Analytical Hierarchy Process* (AHP)

A FRAMEWORK FOR DESIGNING RESEARCH & DEVELOPMENT DEPARTMENT EMPLOYEE PREPARATION IN PT. SEMEN INDONESIA TBK USING INSTRUCTIONAL SYSTEM DESIGN AND ANALYTICAL HIERARCHY PROCESS

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ABSTRACT

ASEAN Economic Community (AEC) which is introduced in 2016, it would have a big impact on the company as there will be inter - company competition. One of the companies affected is Semen Indonesia which controls the production of cement with a production capacity of more than 29 million tons, it`s equivalent to 41.2% of total of cement consumption in Indonesia. So, it is important to do improvement in this field of innovation to compete among ASEAN countries are tightened with this issue. Instructional System Design (ISD) is one method that can provide improved quality of employees through presenting detailed information about the position. In this case, the Instructional System Design (ISD) method was applied to the Specialist or head of section of department of technology and production in PT Semen Indonesia Tbk. Instructional System Design (ISD) Method is combined with analytical hierarchy process (AHP) will provide the information that related to degree of importance of the knowledge and training core which has much needed to be studied. Then, the training, the content of training and the modules that correspond with positions analyzed and made to match the needs of knowledge. This process is basically to find the criteria of knowledge that is absorbed into the maximum, because knowledge required only are displayed. So that, the next incumbent can be prepared to deal with technology issues and can effectively coordinate and conduct research for innovation.

Key Words: Cement, Innovation, Instructional System Design (ISD), Analytical Hierarchy Process (AHP)

PREFACE

Firstly the author would to say Alhamdulillah as the expression of gratitude to Allah SWT. for His blessing and guidance in finishing this final project report. During the completion of this research, many people and communities supported the author. With the most humble and sincere heart, the author wants to thanks to:

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The author realize that this research is far from perfection. Therefore constructive criticism and suggestion is still expected to improve this imperfect report. Hopefully this report can be used as needed.

Surabaya, January 24, 2016

With Sincere,

Author

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INTRODUCTION

In this chapter will be determined about background of observation, problem that would be solved in this observation, purpose and benefits that would be obtained from this observation, then scope that consist of limitation and assumption that would be used in this observation.

1.1 Background

In 2014, Indonesia and several countries in Southeast Asia tried to propose AEC (Asian Economic Community) to strengthen the economy of the ASEAN countries. Indonesia, one of member of the AEC which is agreed to launch cooperation policy between ASEAN countries in 2016. AEC through several policy cooperation made in the economic field are expected to improve the stability and performance of the economy in countries in Southeast Asia.

Figure 1. 1 ASEAN Economic Community Member
(Source: www.kompasiana.com)

In the midst of the opportunities and threats that may occur due to the AEC issue, the Indonesian government was in December 2012 and then create a policy

on the establishment of a holding company to strengthen the local commodity market in the Indonesia and ASEAN sector. One of the companies affected by the policy was in the cement sector consisting of PT. Semen Gresik, PT. Semen Tonasa, and PT. Semen Padang, have managed by PT. Semen Indonesia Tbk since 2012 (ASI, 2013). Selection of the cement sector to serve as the holding company is motivated by local cement demand a continuous increase every year.

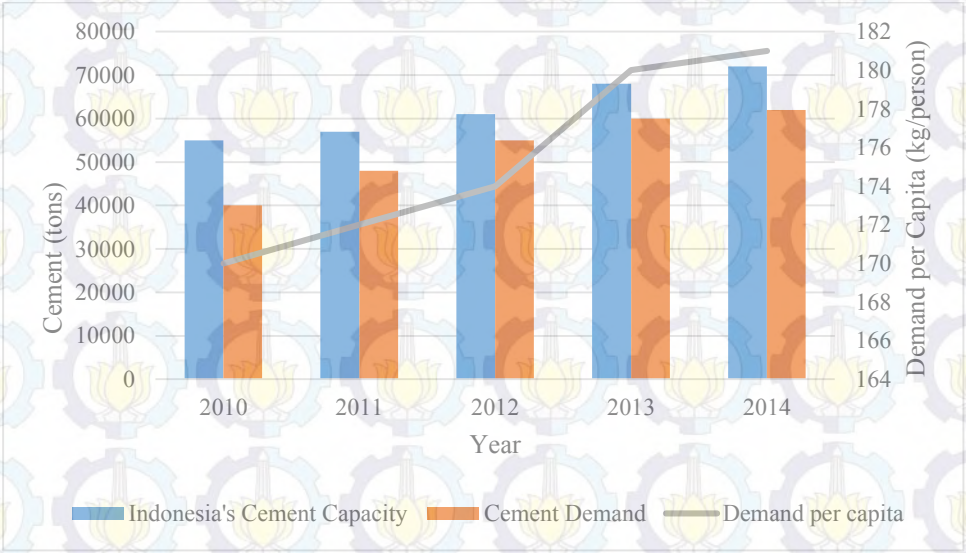

Figure 1. 2 Cement Demand and Fulfillment in Indonesia
(Source: Asosiasi Semen Indonesia)

PT. Semen Indonesia Tbk. was established for the purpose of synchronizing and market dominance in the field of cement. Because if the cement company in the country to compete for local markets alone, would complicate local companies against outside competition. Therefore, the need for cooperation that maximizes fulfillment of the market and market reach. In Indonesia, PT. Semen Indonesia controls about 41.2% to reach 29.5 million tons of cement sales in Indonesia in 2014 (Semen Indonesia, 2014). Then followed by Semen Indocement, Heidelberg Cement of Germany, which reached 23 million tons, and then Semen Holcim to 12 million tons (ASI, 2013).

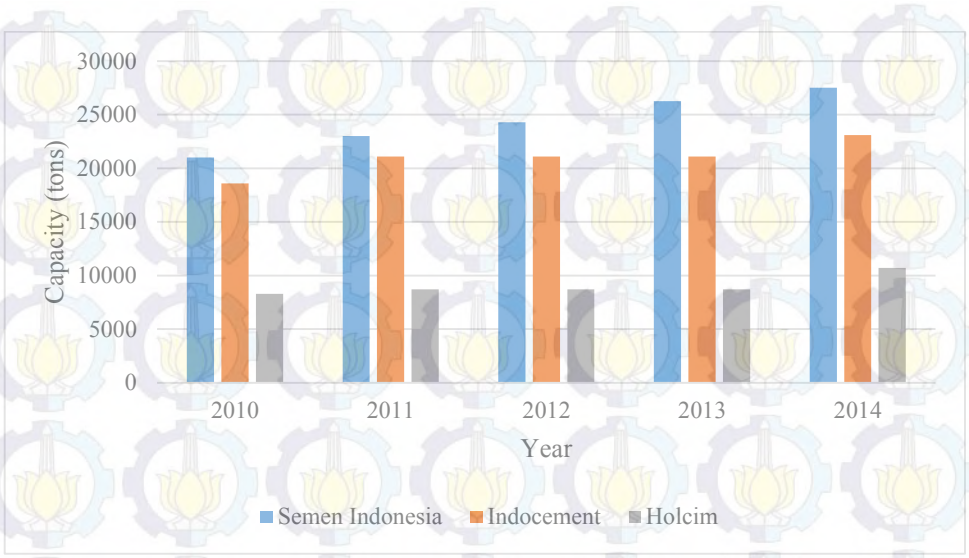

Figure 1. 3 Capacity Level of 3 Major Cement Company in Indonesia
(Source: Asosiasi Semen Indonesia, Kementrian Perindustrian Indonesia, Blog Semen Indonesia, www.commercialgolbaldatareseach.blogspot.com, citated by author)

However, to the degree of fulfillment of cement based on the record of the Indonesian Cement Industry Association (ASI) a private company still holds approximately 56% of sales when compared to the state-owned company in the country consisting of the Indonesian Cement and Semen Baturaja (Supriadi, 2015).

Also it is followed by the increase in external competitors who began to invest in the Indonesian market. According to (Supriadi, 2015), There are about 10 new players in the field of cement in 2017, namely:

1. Siam Cement (SCG) at Sukabumi, which based on Thailand
2. Semen Merah Putih at Banten, which is the subsidiary of Wilmar Group
3. Anhui Conch Cement at Borneo and Papua, which based on Tiongkok
4. Ultratech at Wonogiri
5. Semen Puger at East Java
6. Semen Barru at South Sulawesi
7. Semen Panasia at South Sulawesi

8. Jui Shin Indonesia at West Java, which based on China
9. Semen Gombong at Central Java
10. Semen Grobogan at Central Java

The competition of cement that tighter and heavier encourage the cement company, especially PT. Semen Indonesia Tbk. to continue and competing, one of them in the sector of innovation to achieve efficiency (Wiharto, 2014). So that one of the opportunities that can be made is to increase efficiency in the field of cement. One way is to take the opportunity to make innovations that can improve quality and reduce production costs. Innovation needs to be done in the course of PT. Semen Indonesia Tbk can be in the form of improved inputs, machinery, or addictive into the machine that is used to maximize the quality and minimize the cost of production. The good information and application innovation will certainly be influenced by the system and their regulators.

In improving the quality of the system and their regulators, and achieve the mission and vision of the company, it is necessary for all stakeholders in support of these achievements. For an employee needs to have the ability to handle, manage, and administer at that position (Leonard & Hilgert, 2004). Thus the need to continuously improve the quality of the innovation system and the people who play a role in it. With that, it is necessary to increase again in the future to boost employee performance by improving the quality of competence and knowledge that required in certain positions.

In addition, to support the company's success, it is necessary for a good company in the implementation of competence, train and develop reviews their skills, reviews their measure performance, and develop reviews their leadership potential (During, 2006). Thus, we can conclude that the improvement of the quality of innovation and advancement of the company's internal need for support from companies / workers. For that need to be considered through the SWOT (Strength, Weakness, Opportunity, and Thread) analysis of the company. It aims to determine the company's internal SWOT to determine strategy

accordingly. In this case can be considered through the SWOT of PT. Semen Indonesia Tbk. itself, which is:

Table 1. 1 SWOT (Strength, Weakness, Opportunity, and Thread) analysis

STRENGTHS		WEAKNESSES	
S1	The world class engineering company of technology, innovation, and engineering (Semen Indonesia, 2015)	**W1**	The lack of integration in previous position holder and the current holder (source: HRD)
S2	Skilled employee, which commonly master graduated or experienced. (source: direct observation)	**W2**	The lack of training evaluation (source: HRD)
S3	The innovation number that increase year by year (HRD)	**W3**	The lack of standardization on each position learning or knowledge (source: direct observation)
S4	Semen Indonesia has the highest cement capacity production in Indonesia (Kementerian Perindustrian Indonesia, 2015)	**W4**	Cement sales development in Indonesia depends on the economic growth, currency of rupiah, material availability, etc. (source: direct observation)
OPPORTUNITIES		**THREATS**	
O1	High demand in the market (Bisnis Indonesia, 2015)	**T1**	The lower cement price that may be given by competitors (CNN Indonesia, 2015)
O2	Trends of going abroad (Falah, 2015)	**T2**	Tight competition among cement company in ASEAN (Supriadi, 2015)
O3	The opportunity in widen the market share into ASEAN area (Aneswari, 2015)	**T3**	The regulation for non-Indonesian employee limitation haven't yet applied (source: direct observation)
O4	Indonesia is developing country which required cements as one of the material (source: direct observation)	**T4**	Increased in number of cement industry competitors (Supriadi, 2015)

Results of the SWOT analysis is developed into a strategy that became the focused of PT. Semen Indonesia itself. The next step can be performed by conducting analysis of internal and external condition matrix, by implementing IFE (Internal Factor Evaluation) is a strategy tool used to evaluate firm's

internal environment and to reveal its strength and weakness, also EFE (External Factor Evaluation) is a strategy tool used to examine company's external environment and to identify the available opportunities and threats (Jurevicius, 2014). The IFE and EFE process through and score calculation Expert Choice interests of the parties concerned. Then after knowing the result of IFE and EFE matrix, and gap between internal (Strength & Weakness) and gap between external (Opportunity & Thread) is used to conduct SWOT maps. This SWOT maps is conducted to know the tendencies of company SWOT position. The result is.

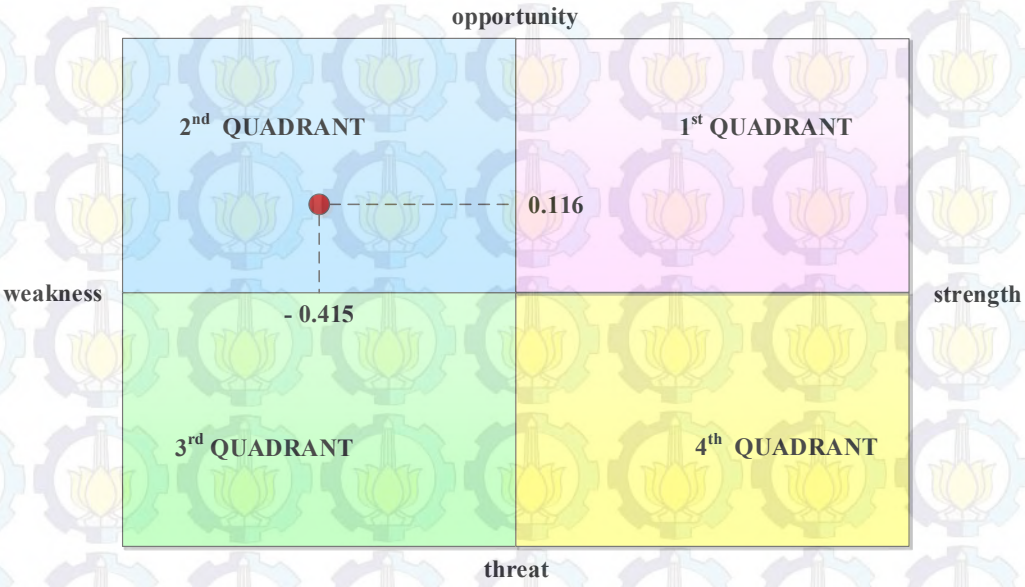

Figure 1. 4 SWOT maps based on IFE and EFE matrix

Seen from the above data that the tendency of the strategy under consideration of the SWOT analysis is a strategy tends to WO (Weakness and Opportunity), which refers to the weaknesses of the company and the opportunities that can be taken to increase the internal strength of the company.

To support the internal strengthen process it, the preparation of the company's internal ability to compete in the field of innovation is the training that is appropriate for a vital position in the R & D department. The framework to covers internal evaluation is urgently needed by the consideration of employee

preparation. One framework that can be conducted is Instructional System Design which known as a method to obtain detail information about knowledge. Integrating the Instructional System Design method with Analytical Hierarchy Process, the framework of ISD can be implemented to strengthen the internal condition by preparing the input of the process.

Technical training in the intended position should also be considered to maximize the quality of employees in R & D that have an impact on the quality of the innovations made, as well as the price and quality of competing in the cement market. Because linking with core competencies tasks makes it possible to operationalize competencies in a more concrete way, which is necessary as indicated resources (M. Adomßent, 2014)

1.2 Problem Formulation

Problem that would be solved in this final report is

- How to determine the training required by specialist of technology and production R&D by applying Instructional System Design Framework
- How to conduct Instructional System Design (ISD) to obtain detail information about knowledge required by technology and production R&D supervisor
- What kind of competencies that needed by incumbent of particular position, and the training schedule that supposed to be taken in the next 5 years
- What kind of training and module's content that required by technology and production R&D

1.3 Observation Purpose

Based on the problem formulation above, hence the purposes that would be achieved on this final report observation are:

1. The training that required by technology and production R&D supervisor
2. The detail information about technology and production R&D supervisor by conducting Instructional System Design (ISD)

3. The competencies that required by incumbent, and the training schedule that supposed to be taken
4. The core competency and training that required, then the design of training

1.4 Observation Benefit

The benefit that achieved by performing this final report observation are:

1. The detail information about specialist technology and production R&D
2. Knowing the function of Instructional System Design (ISD) Framework
3. How to design Instructional System Design (ISD)
4. What training that supposed to be taken in order to increase by technology and production R&D department's employee performance
5. The design of training that supposed to be, in order to increase the quality of department
6. Increase the quality of employee
7. Increase the efficiency of department in performing operation of research and development

1.5 Scope

Scope consist of limitation and assumption that used in this observation. The limitation that will be used in this observation are:

1. Knowledge that would be observed in only on by technology and production R&D of PT. Semen Indonesia (Persero) Tbk.
2. The scope of knowledge that being observed is only supervisor of by technology and production R&D
3. The alternative that considered in this report is limited on the knowledge composition without measuring the quality knowledge
4. The suggested method that conducted neglect any financial calculation, include the return of training investment, tradeoffs, and etc.
5. The Analytical Hierarchy that applied in this research involves only pairwise comparison without applying a whole process of AHP
6. The turnover position is occurred only within and between the technology & production RD employee.

The assumption that will be used in this observation are:

1. During the observation, there is no changing in vision, missions, and company strategy.
2. During the observation, there is no improvement in personal knowledge in every position
3. There's no correlation between each knowledge or training
4. The knowledge of basic cement production is already owned by all employees on PT. Semen Indonesia Tbk.
5. The government policy isn't changing
6. By taking the training, the employees are assumed to be understood the competences that is given
7. The projected position that would hold the specialist technology & production RD is Supervisor/Junior Technology & Product RD.

1.6 Writing system

In this subchapter will be explained about the arrangement of writing that will be used in this observation report. The arrangement of the report are:

- Chapter I : INTRODUCTION

  This chapter will explain about the background of the observation, problem formulation, observation purposes, observation benefits, scope that consist of limitation and assumption, writing system.
- Chapter II : LITERATURE REVIEW

  This chapter main function as the explanation of basic theory or literature that related with the observation. The literature review that will be used in this report are knowledge, knowledge management, knowledge management process, knowledge audit, quality function deployment (QFD), Analytical Hierarchy Process (AHP), Key Performance Indicator (KPI), Instructional System Design (ISD), and cement production process.
- Chapter III : OBSERVATION METHODOLOGY

  This chapter filled with flowchart and the explanation about steps that supposed to be conducted and performed during the observation until the result is achieved and conclusion is made.

- Chapter IV : DATA COLLECTING AND PROCESSING

  This chapter will explain about the method that used to collect information and data that needed to solve the problem formulation and obtain the purpose of observation. Data and information would be collected are company's profile, vision and mission of company, determine the position that will be observed, the job description and work instruction for particular position. Then interview is conducted to related position to verify the detail information of particular position, include the training that experienced by the related person. The training that experienced is useful to obtain the information about the core knowledge that required before. Designing the Instructional System Design (ISD) is the main process of this report, which allows us manage the information about the job description that aligned into work instruction to obtain information about the knowledge and the training that required.

  The next step is conducting the Pairwise comparison with Analytical Hierarchy Process (AHP) to determine which training that the most important one until the less important one, and create the 5 year training plan for the next particular incumbent. Then designing the training for the most important one, include the content, facilitator, and the module that supposed to be owned. Then validate the training include the content and module that created.

- Chapter V : ANALYSIS AND INTERPRETATION

  This chapter basically explains the result of previous chapter, data collecting and processing. The literature review that related with the result of real case calculation. Analysis is result of the calculation, then the interpretation is the conclusion that related with the result of data processing. Result of the analysis and interpretation will be the purpose and basic of conclusion.

- Chapter VI : CONCLUSION AND SUGGESTION

  This chapter will be the last chapter that explains about the solution of problem that being faced by the company. The result of analysis and interpretation that answers the purpose. Then the suggestion will be the

advice that related with the problem of existing condition in PT. Semen Indonesia Tbk.

- BIBLIOGRAPHY

  This part will be filled with the reference resources that used in this report in order to support the basic of the theory and calculations.

- ATTACHMENT

  Attachment is filled with information that obtained in working the observation. Data or information that supporting the theory. It's a real data that can be formed as information and documentation of training between years, etc.

CHAPTER 2
LITERTURE REVIEW

In this chapter will be explained about theory and literature review that would be basic for author to strengthen the understanding and determine the observation method which appropriate with the existing problem. The basic theory that would be used in this report is related with Knowledge which consists of explicit knowledge and tacit knowledge, knowledge management, knowledge management process, knowledge audit, key performance indicator, lean manufacturing, and cement production process.

2.1 Knowledge

Knowledge is defined as a fluid mix of framed experience, values, contextual, information, and expert insight that provides a framework for evaluating and incorporating new experience and information (Davenport & Prussak, 1998). It originates and is applied in the minds of knowers. In organizations, it often becomes embedded not only in documents or repositories but also in organizational routines, processes, practices, and norms. Knowledge is intellectual asset that important for both of profit or non-profit organization.

Then understanding knowledge is obtained through the process of experience or appropriate study (Awad, 2004). Knowledge can also be accumulation of facts, procedural rules, or heuristic. A fact is generally a statement representing truth about a subject matter or domain. Then procedural rule stands for a rule that describes a sequence of action. Heuristic is a rule of thumb based on years of experience.

The basic of process knowledge is divided into data, information, knowledge, wisdom. Data can be described as raw material of the product. Data represents unorganized and unprocessed facts. The characteristics of data are:

- Static in nature
- Represents a set of discrete facts about events
- A perquisite of information

- An organization sometimes has to be decided on the nature and volume of data that is required for creating the necessary information

Information is a result of processing data. It can be considered as an aggregation of data (processed data) which makes decision making easier. Information has usually got some meanings and purposes.

Knowledge is known as human understanding of a subject matter that has been acquired through proper study and experience (Awad, 2004). It usually based on learning, thinking, and proper understanding of the problem area. It's neither a data nor an information. It's obtained through the process of data and information, the process is purposed to filter the only important and appropriate data or information that will be useful. The point of view of choosing is by its importance or relevance to the problem area. Knowledge also is a result of human perspective and information to create a meaningful conclusion.

Wisdom is how the conclusion and decision is made. Wisdom is the result of the knowledge that owned by person. Knowledge itself is commonly made to solving a problem. The solving problem can be done by combination of several knowledge, and making a decision.

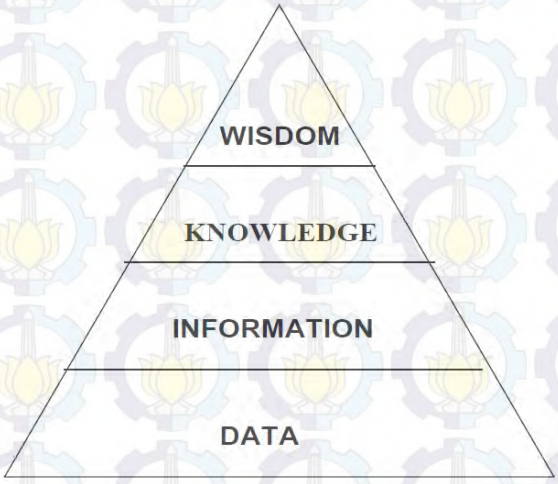

Figure 2. 1 Data, Information, Knowledge, and Wisdom Diagram (Source: www.crethq.com)

Basically knowledge are known to be owned by person. But how to implementing and using the knowledge is divided in 2. Those 2 kinds of knowledge which are explicit knowledge and tacit knowledge, can be explained as:

a) Explicit Knowledge

Explicit knowledge can be jointed into formal language, including words and numbers, mathematical expressions, specifications, manuals, etc. Explicit knowledge can be easily transmitted or transferred formally and systematically. It can be explained as method, process, business procedure, or experience. Explicit knowledge can be distributed by electronic gadget or database and processed in computer.

b) Tacit Knowledge

Tacit knowledge is personal knowledge embedded in individual experience and involves intangible factors, such as beliefs, perspective, and the value system. Tacit knowledge is hard to articulate with formal language (hard, but not impossible). It contains subjective insight, intuitions, and hunches. Before tacit knowledge can be communicated, it must be converted into words, models, or numbers that can be understand.

Furthermore, tacit knowledge has two dimension that determine knowledge:

- **Technical Dimension (procedural):** This encompasses the kind of informal and skills often captured in the term know-how. Technical dimension is dimension that the point of view is technical and scientific principles. It can be described as the exact measurement for creating a product.
- **Cognitive Dimension:** Cognitive itself is sphere which concerning of mental or brain performance. There are 6 aspects that consist on cognitive which are: knowledge, comprehension, application, analysis, synthesis, evaluation. But for knowledge, especially tacit knowledge, cognitive dimension consists beliefs, perceptions, ideals, values,

emotions, and mental models so ingrained in us that we take them for granted.

There are four modes of knowledge creation or conversion that are derived from the two kinds of knowledge (Nonaka, 1995):

Table 2. 1 Table of Knowledge Interaction

	To Tacit Knowledge	**To Explicit Knowledge**
From Tacit Knowledge	Socialization	Externalization
From Explicit Knowledge	Internalization	Combination

Source: www.cosent.nl

- **Socialization**

  Interaction between tacit knowledge to tacit knowledge; sharing mental models and technical skills in order to create another tacit knowledge. This knowledge usually resulted by experience, so that transfer information often to makes little sense to the receiver. This process commonly concerns about observe, imitate, and practice.

- **Internalization**

  Interaction between explicit knowledge to tacit knowledge, can be described as "learning by doing". The reformation of knowledge from written text to mindset. Knowledge is verbalized or diagrammed into documents or oral stories.

- **Externalization**

  Interaction between tacit knowledge to explicit knowledge. This process concern on capturing knowledge. The quintessential process of articulating tacit knowledge into explicit concepts through metaphors, analogies, concepts, hypothesis, or models. Note that when we conceptualize an image, we express its essence mostly in language.

- **Combination**

  Interaction between explicit knowledge to explicit knowledge. A

process of systemizing concepts into a knowledge system. Individuals exchange and combine knowledge through media, such as documents, meeting, and conversation. Information is reconfigured by such means as sorting, combining, and categorizing. Formal education and many training programs work this way.

Organizations initiate innovation that related with knowledge that can improve their business process and performance in order to win the competition with other organization. Knowledge Management is one method that can be applied in organization. The definition of Knowledge management is effort in performing something useful on knowledge in order to achieve organizational goal by developing human, technology, and knowledge. Knowledge management consist of filtering process, distributing process, and using knowledge effectively (Davenport & Prusak, 1999). Same with the other definition from Business Architects (1999), the definition of knowledge management is a process of identifying, capturing, organizing, purchasing, and dissemination of information to increase profitability and advantage in competing. Then also from Maholtra (1997) said that Knowledge Management is organizational process which looking for synergic combination of data and information processing capacity on information technology, and innovative capacity of human. Knowledge management gather information on the internal of the organization in order to make it synergy and work efficiently. The other definition says that knowledge management is tool that used in business process, O'Brien (1999) defines knowledge management as a company collaboration tool that serve organization and management in sharing of all kinds of business information that created by individuals and teams on organization. Knowledge management is one important and powerful tool for company to control owned resource, in order to obtain desired competitive advantages (Roy et al, 2000). High competitive advantages are needed, since the manufacturing industries are developing days by days, so does the competitor in the same sector of company.

The application of knowledge management isn't even involve the product, as it says by Bill Gates (19..) said that Knowledge management is not a software

product. Knowledge management doesn't even start with technology, it starts with business objectives and processes and a recognition of the need to share information. This statement says that the main point of business process is not just producing the product and fulfill customers demand, but also knowledge management which concern in information sharing.

2.2 Knowledge Management

Knowledge Management is becoming trends for companies in current years. The reason for applying this process as their business process is this process provides ease in accessing and sharing knowledge. Knowledge Management itself is an intangible asset, as knowledge, has replaced tangible asset as main trigger of economic growth (Boisot, 2002). McInerney (2002) stated that Knowledge Management is an effort to increase that useful for organization, such as performing communication culture between employee, giving chance to learning, and initiating sharing knowledge. The effort by performing Knowledge Management method is to initiate the courage of employee to share the expert capabilities in certain knowledge. The result is the uneven in knowledge capabilities can be reduced. Murray (2002) said that the basic of knowledge management is an act of managing corporation knowledge and intelligent asset that could increase the performance in organizational scale and gives added value. Then the concern of knowledge management is also on knowledge storage and processing, because knowledge management is a process of managing and increasing knowledge keeping systematically on the organization (Laudon & Laudon, 1998).

Generally, the usage of Knowledge Management in companies have several processes, which are identifying, capturing, sharing, applying, and recreating knowledge.

De Jarnett (1996) defines Knowledge Management as process of creating, interpreting, distributing, purifying, and determining knowledge. Then Brooking (1997) defines Knowledge Management as activity that related with strategy and method in order to managing asset that related with human resource in the company. It shows that the advantages of Knowledge management is to utilizing

the knowledge that owned by company itself. Besides, the knowledge that owned by person on the company can be measured by the company. The method to measure the performance or Knowledge Management is performance measurement. Performance Measurement is a crucial matters in applying Knowledge Management, because performance measurement provides basic that make possible to organization for evaluate, control, and increase knowledge process. Then Knowledge Management measurement is related with characteristic that includes subjectivity, transferability, unity, self-strengthen, spontaneity, and all the unseen character (Kluge et al., 2001).

Back to Knowledge Management concept, knowledge Management consists of 4 steps that's defined as CODE, which stands for:

- Collect Information
- Organize it
- Disseminate it
- Evaluate It's Utility

The steps is actually related with the assessment process that consists of identifying, capturing, sharing, applying, and creation. Collect information stands for identify the information or knowledge that need to be observed, this process concern about the detail of information about knowledge. Then organize the knowledge to make it simple and better. Disseminate stands for sharing the knowledge that already learned. The dissemination also has responsibility in applying the knowledge that's shared. Then the last is "evaluate it's utility" stands for the feedback or output from the application, is it good or not. The evaluation also consider the reliability of the knowledge to be used. The improvement can be performed in this evaluation phase.

2.3 Knowledge Management Process

Knowledge management which already explained before has main process of steps. In the previous sub chapter, there are 5 steps that exist to verify that those processes are in one cycle of knowledge management application, which

are: identify knowledge, capture knowledge, sharing knowledge, applying knowledge, and creation. The steps is actually related with the assessment process that consists of identifying, capturing, sharing, applying, and creation.

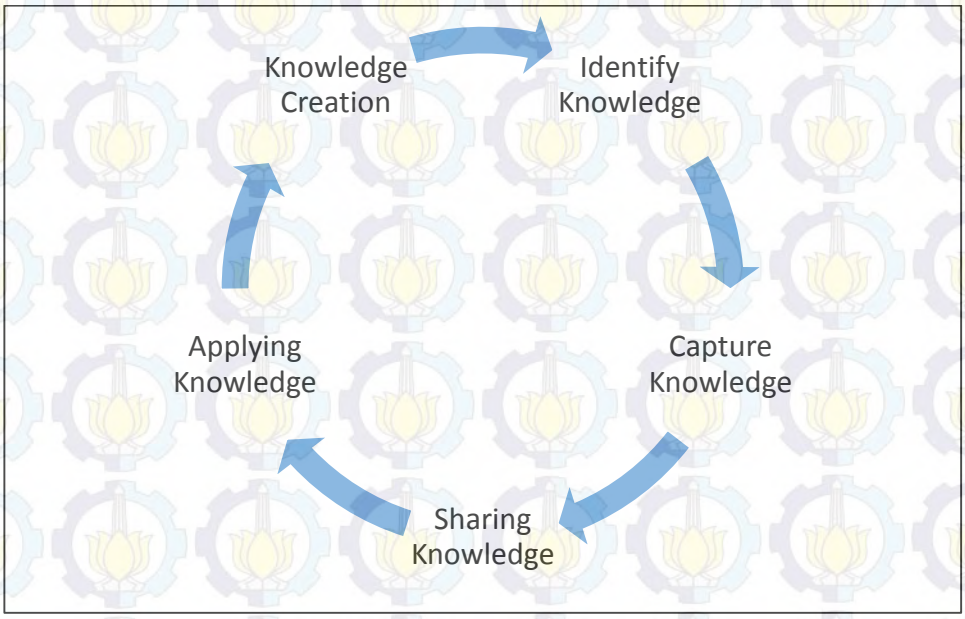

Figure 2. 2 Knowledge Management Process (Source: www.teamcarney.com)

2.3.1 Identify Knowledge

Knowledge identification is a method to develop either new tacit knowledge or new explicit knowledge from data, information, or combination that taken from previous knowledge (Beccer-Fernandez, 2004). The knowledge also must be useful in some way, means that the combination must be correlated with the requirement of the company. Knowledge identification focused on understanding knowledge attribute that required, choosing existing knowledge and place the knowledge asset that required to be learned and created.

This process concern about finding the certain knowledge and find out about the detail of the knowledge. The detail can be about the person that capable in that knowledge, the position that need to be educated to learn about this knowledge, and where the knowledge can be discovered.

2.3.2 Capture Knowledge

Knowledge capturing can be defined as process of capturing explicit knowledge or tacit knowledge on person/individual or group, artifacts/technologies, organization units (Beccer-Fernandez, 2004). This process is actually the replacing knowledge process from tacit knowledge to explicit knowledge. The process of capturing knowledge commonly perform by the expert of certain knowledge, then record the knowledge into database or website. The usage of recording is to ease the other to access and learn about the knowledge that already captured.

2.3.3 Sharing Knowledge

Sharing knowledge is one application form of knowledge which involves 2 or more person in doing communication and interaction. The role is knowledge giver who giving or transferring the knowledge and knowledge receiver who receive the knowledge given by person. Process of sharing knowledge is transfer knowledge between expert to others or vice versa. Sharing knowledge can be performed by direct or indirect transfer. The example of direct sharing is briefing, forum group discussion, or private discussion between persons. Than for the indirect transfer is commonly began with capturing the knowledge. So the person who need the knowledge, can access certain website or read source that created by the expert.

2.3.4 Applying Knowledge

Applying knowledge is basically the knowledge action or performance that being done by receiver. The knowledge that apply can be the same as the giver said, or can be improved by the receiver follow and adjust the current circumstances. Applying knowledge is the application of knowledge that person's learned by the expert in the real case. The output of knowledge that being applied isn't constant, even the method is similar.

2.3.5 Knowledge Creation

Knowledge creation is actually the step which consist of combination between knowledge identification, knowledge evaluation, and knowledge

improvement. This process is the output of previous process, applying knowledge. By the output of applying knowledge that's not constant, the person who applied this knowledge can learn something new from their experience of application. Then this process can loop back to capturing the knowledge, to share the new perspective of output. This evaluation step taken from the knowledge that applied in the case study, whether the result is good or not. Then the knowledge improvement can be performed by improving the current method or knowledge that imperfect in previous case. Then knowledge identification is taken by learning the new knowledge that already improved or combined to be identified again.

2.4 Knowledge Audit

Knowledge audit is a phase or knowledge management initiative step which performed to support the investigation on company's health (Paramasivan, 2003). Knowledge audit is considered as the crucial first step prior to introduction of any knowledge management programs, as it could help examining the readiness (Choy, 2004). The knowledge audit provides tools to help organization discovering all important aspects in implementing knowledge management program. Knowledge audit is believed to provide an organization a more effective way to implement their knowledge management. The knowledge management that being investigated is facility analysis, interpretation, and activity report that involves study of company's information, knowledge policy, knowledge structure, and knowledge flow. Knowledge audit can help company on determining what known and unknown, also can help company on auditing for processed knowledge determination and how good the processed knowledge. Knowledge audit identified main information, requirement, and knowledge usage on companies, so that identified gap, duplication, flow, and knowledge contribution in business goal. The purpose of performing knowledge audit (Paramasivan, 2003):

- To provide high level view of limitation, nature, and particular knowledge structure

- To provide advice about unreachable data which important to knowledge processing strategic plan
- To identify repository knowledge that relevant
- To provide statement related to qualitative characteristics of knowledge with special specification
- To provide scientific estimation related to qualitative characteristics of knowledge with special specification

Question that related with knowledge audit and business concept, Enterprise know-how, knowledge, knowledge performer, knowledge mediation through IT, and company design (Shah & Pathak, 1998). In order to performing knowledge audit, person and company must follow some steps. The point of performing knowledge audit by steps is achieving the optimum result of auditing. The steps of performing knowledge audit (Paramasivan, 2003):

1. Identify the existing knowledge on observed area
2. Identify the disappeared knowledge on observed area
3. Provide recommendation from knowledge audit for management which related with status-Quo and improvement activities that performed to knowledge management area that observed.

The approach that can be performed in knowledge audit related to Paramasivan (2003) are:

1. **Knowledge requirement identification**
   This knowledge requirement is being observed by related stakeholders in purpose to support company on achieving target. The approach is commonly as questionnaire, interview, and FGD (Facilitated Group Discussion)
2. **Knowledge inventory description**
   In this phase the activity is related with calculating and categorizing the tacit knowledge and explicit knowledge. Knowledge inventory is a stock

to identification and description the knowledge asset location or knowledge resource

3. **Knowledge flow analysis**

   Knowledge flow analysis is purposed to monitor how the knowledge can find required knowledge, the worker can discover knowledge that required and can share the knowledge that owned.

4. **Knowledge mapping**

   Knowledge mapping is a form of knowledge representation on a company. Basically there are 2 kinds of knowledge map approach that is used:

   - Knowledge resource and knowledge asset location mapping
   - Knowledge resource and knowledge asset with knowledge flow

According to Paramasivan (2003), there are 10 methods that can be performed to obtain knowledge audit, which are:

- **Survey knowledge questionnaire**

  To obtain the wide overview of knowledge operation condition

- **Middle management group session**

  To identify the knowledge that related with certain urgent condition

- **Environmental analysis task**

  To obtain the information about the details of existing knowledge and its function

- **Verbal protocol analysis**

  To identify the elements, fragments, and the core of knowledge

- **Basic knowledge analysis**

  To identify the combination and details of knowledge

- **Knowledge Mapping**

  To develop the concept mapping as network or flow

- **Critical knowledge function analysis**

  To find the sensitive knowledge area

- **Knowledge requirements and usage analysis**

To identify the requirement of knowledge to be performed, then how the knowledge is performed in order to achieve business goal and how to improve the situation

- **Knowledge scripting and profiling**

  The identify the details of knowledge performance and which knowledge is taking role in producing qualified products

- **Knowledge flow analysis**

  To obtain the wide overview of knowledge related with exchange, benefit, and business process task of the company's whole process flow

2.5 Quality Function Deployment (QFD)

The success of a product or service is indicated on how they meet the customer's needs and expectations. Consequently, more effort is involved in getting the information necessary for determining what the customer truly wants. One process-oriented design method constructed to carry out the translation process and make sure that the findings are implemented is quality function deployment (QFD). QFD is visual connective process that helps team focus on the needs of the customer throughout the total development cycle. Then QFD is mainly a people system. Its point of departure is the "voice of customer" (VOC). It also brings together the multifunctional teams to work together toward satisfying the customer. QFD can help the companies to make the key trade-offs between what the customer wants and what the company can afford to build.

QFD process is the phases that performed to generate the attribute to shows the technical responds of attribute. The QFD process involves four phases:

1. Product planning: House of Quality/House of Knowledge
2. Product design: parts deployment
3. Process planning
4. Process control (quality control charts)

A chart (matrix) represents each phase of QFD process. The complete QFD process requires at least four houses to be built that extend throughout the entire

system's development life cycle. But In this report, author will perform only one level of QFD process due to the usage of house of knowledge only requires 1 level of house, but the process that performed will be similar as common QFD process. So the form of house of quality/knowledge would be like figure xx below.

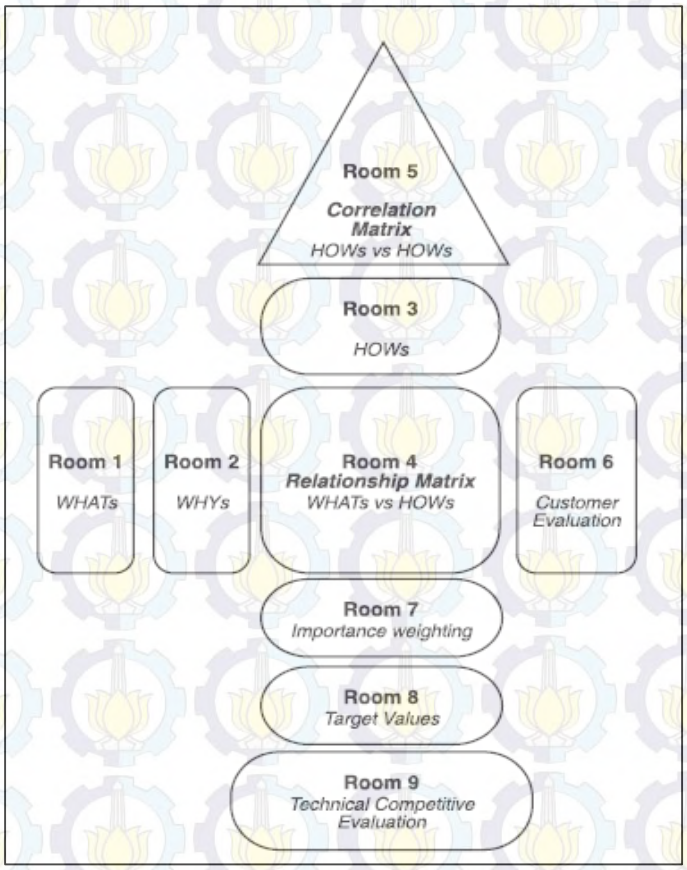

Figure 2. 3 House of Quality Diagram (Source: Author)

Then the placement can be seen as the example of house of quality for a paper-roll manufacturing process on figure 2.5 below

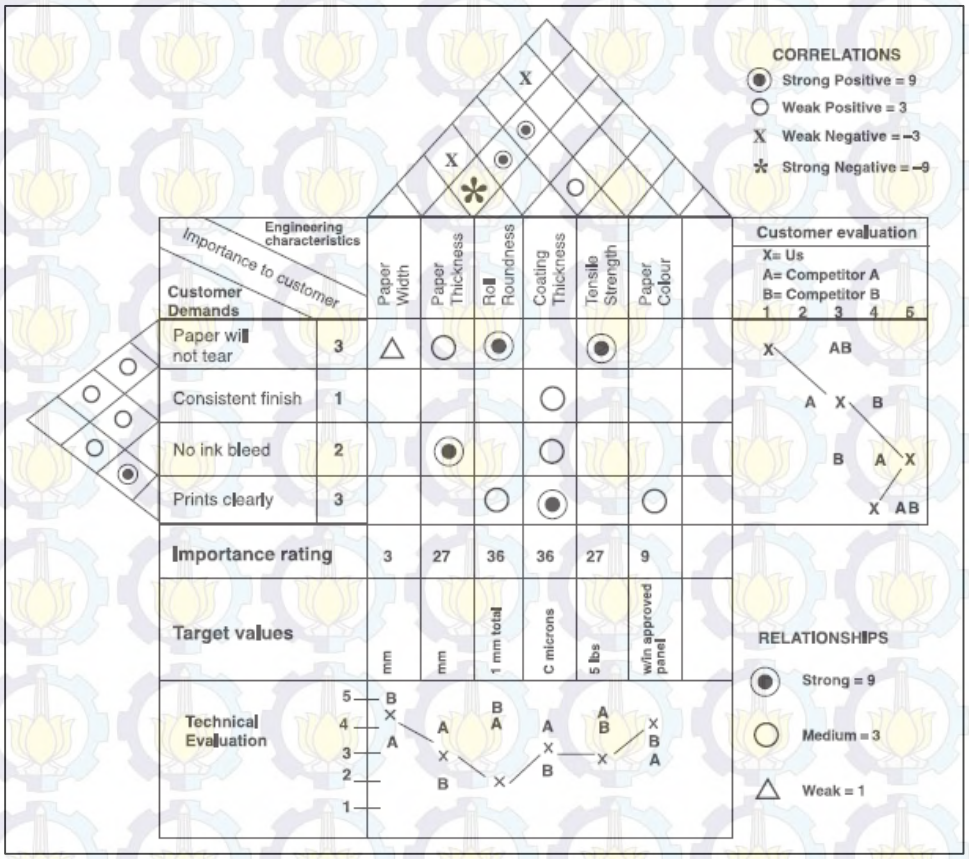

Figure 2. 4 The Example of House of Quality on Paper-Roll Manufacturing Process (Source: www.syque.com)

The left side is for customer demands which correlated with voice of customer (VOC), the data is taken from questionnaire, interview, or Facilitated Group Discussion (FGD). Then the upside is for the mitigation that can be performed by the company as the response of issues. Then giving the correlation and relationship using the objective view of observer, then record the technical respond by the ranking of importance.

2.5.1 Analytical Hierarchy Process (AHP)

One of the QFD application is AHP (Analytical Hierarchy Process) which allows the user to put priority on some attributes based on questionnaire and state it as the most important attribute instead of another attribute. It's an effective tool for dealing with complex decision making, and may aid the decision maker to set priorities and make the best decision (Saaty, 1980). There are commonly

several options/alternatives in terms of number of criteria to results a final decision. The basic purpose of using AHP is because the AHP generates a weight that can be useful to compare each of attributes or alternatives that own. The method of AHP is by pairwise comparison for the best decision making of the criteria. The higher weight that owned, the more important the corresponding criteria.

The calculation can be conducted in 3 simple steps:

1. Computing the vector of criteria weight

   In order to compute the weights for the different criteria, the AHP starts creating a pair-wise comparison matrix A. The matrix A is a m×m real matrix, where m is the number of evaluation criteria considered. Each entry of matrix A represents 2 criterions, for example j and k. A a_{jk} of the matrix A represent the importance of the *j*th criterion relative to the *k*th criterion and vice versa. $a_{jk}>1$ means *j*th criterion is more important than *k*th criterion and vice versa. The entries a_{jk} and a_{kj} satisfy the following constraints:

   $a_{jk} \times a_{kj}=1$ ……(2.1)

   $a_{jj}=1$ for all j……(2.2)

   The relative importance between 2 criteria is measured according to a numerical scale from 1 to 9, as shown in Table 2.2 below.

Table 2. 2 The Relative Importance between 2 criterion

Value of a_{jk}	Interpretation
1	j and k are equally important
3	j is slighty more important than k
5	j is more important than k
7	j is strongly more important than k
9	j is absolutely more important than k

(Source: Author)

Once the matrix A is built, it is possible to derive from A the normalized pairwise comparison matrix A_{norm} by making equal to 1 the sum of the entries on each column, i.e. each entry a_{jk} of the matrix A_{norm} is computed as

$$\boldsymbol{a(jk)} = \frac{a(jk)}{\sum_{l=1}^{m} a(lk)} \quad \text{.....(2.3)}$$

Finally, the criteria weight vector w (that is an m-dimensional column vector) is built by averaging the entries on each row of A_{norm} i.e.

$$\boldsymbol{w(j)} = \frac{\sum_{l=1}^{m} a(jl)}{m} \quad \text{.....(2.4)}$$

2. Computing the matrix of options score

The matrix of options scores is a n×m real matrix S. Each entry S*ij* of S represents the score of the i*th* option with respect to the j*th* criterion. In order to derive such scores, a pair wise comparison matrix $B^{(j)}$ is first built for each of the m criteria, j=1,…,m. the matrix $B^{(j)}$ is a n×n real matrix, where n is the number of options evaluated. Each entry $b_{ih}^{(j)}$ of the matrix $B^{(j)}$ represents the evaluation of the i*th* options compared to the h*th* option with respect to the j*th* criterion. If $b_{ih}^{(j)}>1$ thus i*th* option is better than the h*th* options and vice versa. If 2 options are evaluated as equivalent with respect to the j*th* criterion, then the entry $b_{ih}^{(j)}$ is 1. The entries $b_{ih}^{(j)}$ and $b_{hi}^{(j)}$ satisfy the following constraint:

$b_{ih}^{(j)} \times b_{hi}^{(j)}=1$ .....(2.5)

And $b_{ii}^{(j)}=1$ for all i. An evaluation scale similar to the one introduced in Table 1 may be used to translate the decision maker's pariwise evaluations into numbers.

Second, the AHP applies to each matrix $B_{(j)}$ the same two-step procedure described for the pair-wise comparison matrix A, i.e. divides each entry by the sum of the entries in the same column, and then it averages the entries on each row, thus obtaining the score vectors $s^{(j)}$, j=1,…,m. The vector $s^{(j)}$ constraints the scores of the evaluated options with respect to the jth criterion. Finally, the score matrix S is obtained as:

$S=[s^{(l)}…..s^{(m)}]$ .....(2.6)

i.e. the j*th* column of S corresponds to $s^{(j)}$

3. Ranking the options

Once the weight vector w and the score matrix S have been computed, the AHP obtains a vector v of global score by multiplying S and w, i.e.

$V=S\times w$……(2.7)

The i*th* entry v_i of v represents the global score assigned by the AHP to the i*th* options. As the final step, the options ranking is accomplished by ordering the global scores in decreasing order.

2.6 Key Performance Indicator

Key Performance Indicator (KPI) is an indicator which is the method that used to perform performance measurement. Performance is a description about implementation achievement level in a task/program to achieve target, goal, mission, and vision of organization that written on organization's strategic planning. Than measurement is the tool or method that's used to determine the achievement level of certain factor. Performance can be seen from the achievement that's made in the beginning of the job/task, which can be performed by personal or group. Mahsun (2011) stated that without target or goal, performance of person or group can't be possibly known, because there is no key performance indicator (Mahsun, 2009).

Robertson (2002) defined performance measurement as an achievement marking process align to the purpose and target that already determined before, such as information about: source usage in creating product or service, quality of product or service (the quality of product, and the satisfaction of customer), result of task compared with the desired result, and the effectiveness of performance in achieving target (Robertson, 2002).

Then for the method, Luis & Prima (2007) defined Key Performance Indicator as indicators that used to measure performance. Key Performance Indicator (KPI) also can be defined as quantitative performance measurement that used by company to measure and to compare strategic and operational purpose fulfillment (Investopedia, 2012). Key Performance Indicator (KPI) is applied to be a trigger for employee. By applying KPI employee will be creative

in finding something new, in order to achieve KPI. KPI value is commonly determined by the department itself. The CEO commonly just give a minimum value of KPI, then the policy of department will measure the existing value. The determination of value is given to the department due to the one who knowing their department is the department itself.

The purpose of applying KPI is also the detail information about the goal that need to be achieved by the company and department. By knowing the detail information about goal, the employee will be more triggered, since the mission of company that must be fulfilled by them is clear, so it's also increase their sense of belonging to the company.

Parmenter (2007) defined Key Performance Indicator (KPI) in 3 types of performance measurement, which are:

1. **Key Result Indicators**, describes what kind of the perspective achievement
2. **Performance Indicators**, describes what job that must be performed
3. **Key Performance Indicators**, describe what should be performed in order to increase the performance dramatically

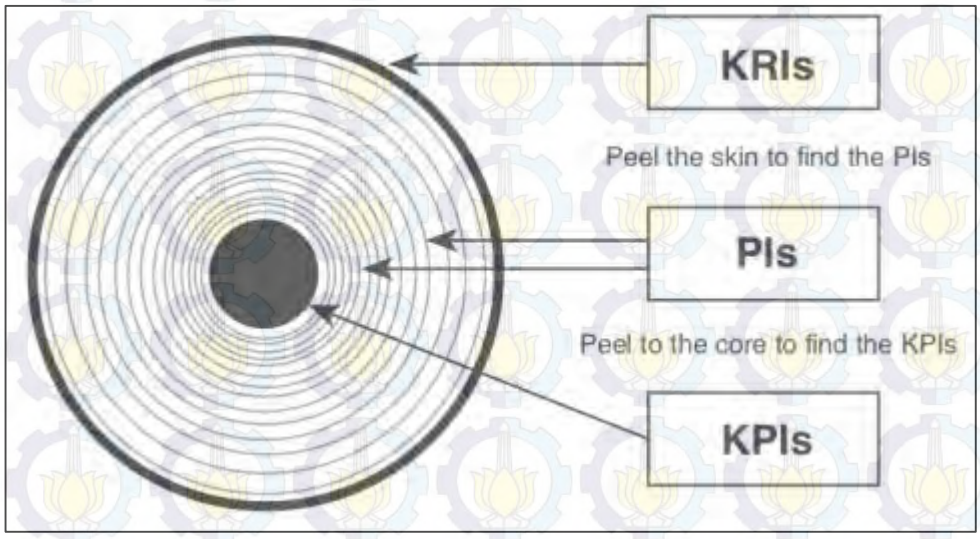

Figure 2. 5 Performance Measurement, KPI, KRI, and PI

It's not easy to determine Key Performance Indicator (KPI) due to mistaken determination in Key Performance Indicator (KPI), so the organization performance that's resulted wouldn't be relevant (Sholihah, 2012). Key

Performance Indicator that created must be appropriate with existing condition of department or company. The standard that should be followed is align to Parmenter's. Parmenter (2007) also said about the 7 characteristics of effective Key Performance Indicator (KPI), which are:

1. Non-financial measurement (Not in currency)
2. Multiplication measurement (days or 24 hours/7 days)
3. Followed up by elder management team
4. All member of organization (MOO) must understand the measurement and correction act.
5. The responsibility is given either to personal or group
6. Significantly has impact
7. It has positive impact

In determining Key Performance Indicator (KPI), the parameter must be SMART (Sholihah, 2012). SMART stands for Specific, Measurable, Agreeable, Realistic, and Timebound. Specific means the parameter that being used must be to the certain point, not ambiguity. Measurable means the achievement of performance can be measured by determining certain circumstance on the parameter. Then the 3rd is agreeable means the parameter that being used can be easily to be agreed. Realistic means the parameter that being used is real, can be performed and achieved by the company existing condition. Because the parameter of KPI must be related with the company existing condition. Timebound means the KPI parameter is bounded with time parameter. The parameter will be constrained with time limit, so in the certain time the parameter will be checked and measured.

The Key Performance Indicator is closely related with collecting data. As the Performance indicator is marking the achievement of company, so the existing condition of company must be known in the place. The next step that must be taken is determining the expected value that desired by the company or the department. The determination of existing and expected value is commonly made by chief of company or department, then the value shows the performance

condition. If the existing and expected has the same value or more than the expected value, the performance of department or division is good.

Furthermore, Key Performance Indicator also concern in scoring the performance of organisation. According to Sholihah (2012) to obtain a scorecard from an organisation as a report, it's required to calculate the value of organisation performance on every strategy target, can be calculated by:

Score = (Actual : Target) x Weight

That formula shows the Scoring can be performed by calculating existing condition, expected value and weight of the department or company. Those data can be taken by collecting data to the company and distribute it to the formula.

2.7 Instructional System Design (ISD)

This Instructional System Design is originally initiated by Malcolm Knowles on 1984 by the theory of Andragogy. Andragogy itself is a art and science of helping adult to learn, by following assumption about design of learning:

1. Adults need to know why they need to learn something – adults need to be involved in the planning and evaluation of their instruction
2. Adults need to learn experientially – experience including failure and mistake provide the basic for learning activities
3. Adults approach learning as a problem-solving – adults are most interested in learning subject that have immediate relevance to their job or personal life
4. Adults learn best when the topic is of immediate value – in practical terms, andragogy implies that instruction for adults need to focus more on the process and less on content being taught. Instructional strategies like case studies, class discussion, role playing, simulation, and self-study are most useful.

Then in 1998, by combining the andragogy system and implementing technology, Ginsburg (cited in Imel, 1998) proposed how to integrate technology into adult learning by proposing four basic approaches:

1. Technology as curriculum: adults learn not only content through technology, they can also learn about the technology itself
2. Technology as delivery mechanism: this approach for integrating technology into adult learning is to use it as means for instructional delivery
3. Technology as complement to instruction: technology is frequently used to complement instruction and extend adult learning
4. Technology as instructional tool: when it is integrated with instructional tool, it also integrated with instructional activities for adult learning (Ngamkajonviwat, Atisabda, Kaosaiyaporn, & Churngchow, 2014)

On 2002, Robert Resier and John Dempsey proposed a framework for designing learning activities, which are the learning activities in accordance with constructivist are:

1. Analysis stage which comprises analyses of learning context, learner, problem described, key concept identified of occurrence of learning concept
2. Design stage which comprises learning goals, identify learning sequences, and the context – driven evaluation
3. Development stage which comprises the construction of learning resource/artifact
4. Implementation stage which comprises the teacher, consulting, facilitating, directing, controlling, and problem solving
5. Evaluation stage which shows how the learner knows (Saekhow, 2015)

Then earlier in 2012, Dibta Group Consultant which hired by PT. Semen Indonesia Tbk., initiated the Instructional System Design (ISD) to their Center Dynamic Learning (CDL) Department. The basic application approach of ISD in CDL of PT. Semen Indonesia is on their study planning.

There are commonly 3 types of learning:

1) Learning before doing, which defined by the training is conducted before the person perform their job
2) Learning while doing, which defined by giving the training while the job is performed

3) Learning after doing, which defined by the learner asked to understand the job and situation based on their experience of working on it

In this case, Dibta Group using ISD method to be applied on learning before doing on employee by aiming the position of each employee. The Instructional System Design would be applied on every position on PT. Semen Indonesia by interviewing each of them. Then knowing the basic purposes of the position, the job role, the knowledge that related with each job description, then the last is training that required according to the knowledge that related to the job description.

2.8 Cement Production Process

In producing cement, must be a standard procedure which allows the worker or operator to look as their reminder. The standard procedure of cement production is (PT. Semen Padang, 2015):

1. First step is mining the raw material (quarry). Raw material of cement is limestone, clay, iron sand, and silica sand. These materials are mined using heavy equipment and then shipped to the cement factory
2. These raw materials are studied in the laboratory, then mixed with the proper proportions and begin the initial stages of grinding material with shredder until the material is powder formed.
3. Material is then heated in preheater
4. Heating is continued in the kiln so that react to form a crystal clinker
5. Crystal clinker is then cooled in the cooler with the help of the wind. The heat from cooling process is piped back to the pre-heater to save the energy
6. Clinker is refined again in rotating tube sided steel balls so the refined cement becomes smoother and resulting a fine cement powder
7. Clinker that has been refined is stored in silo (cement storage which like shelter of oil tank)
8. From this silo, finished product cement is packed and sold to the customer

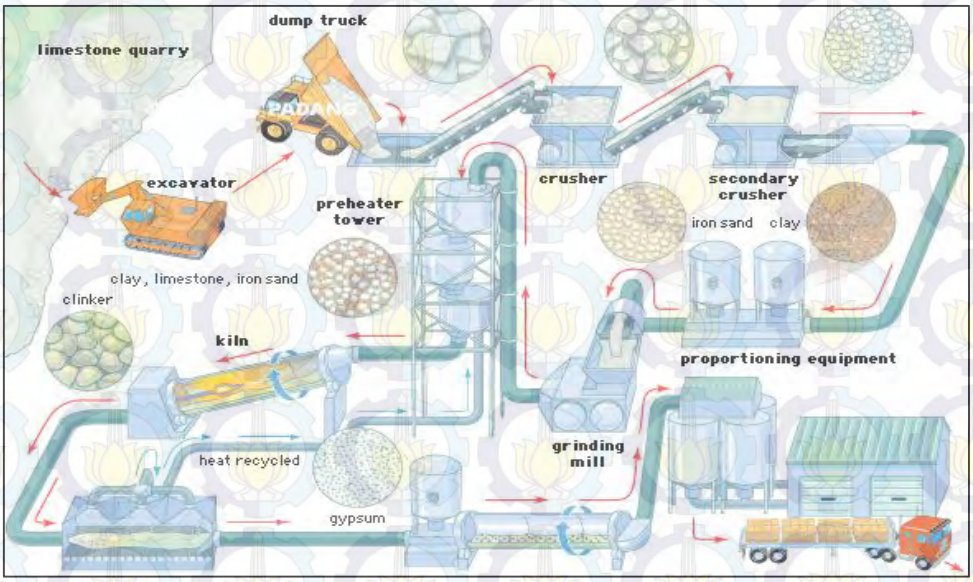

Figure 2. 6 Cement Production Process (Source: www.semenpadang.co.id)

CHAPTER 3
OBSERVATION METHODOLOGY

In this chapter will be explained about the steps that's performed in the observation. Steps that written on this chapter will be the basic and guidance of the author in performing the systematic observation

3.1 Flowchart of Methodology

The methodology that being used in this report is a guidance for the author to perform the research. The flowchart is:

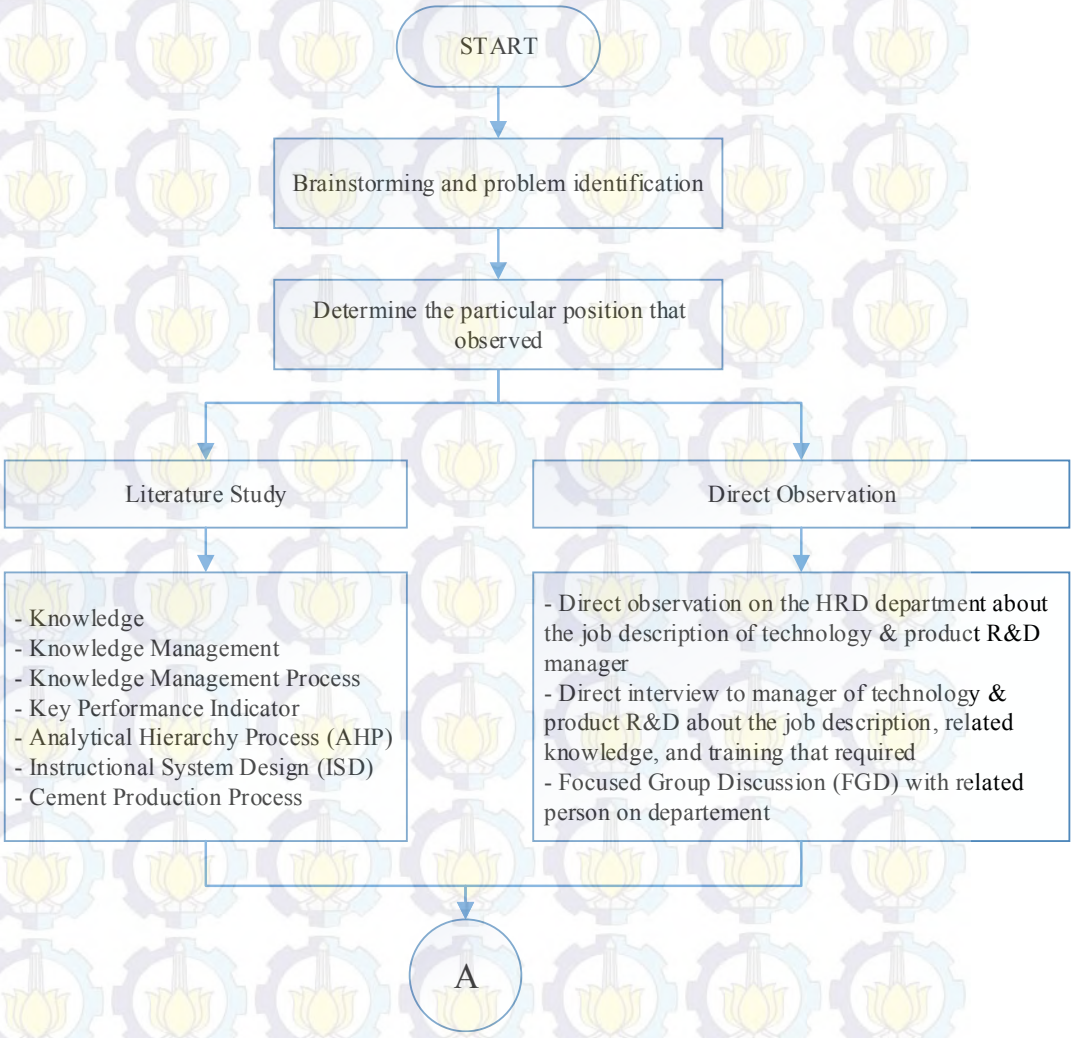

Figure 3. 1 Flowchart of Methodology

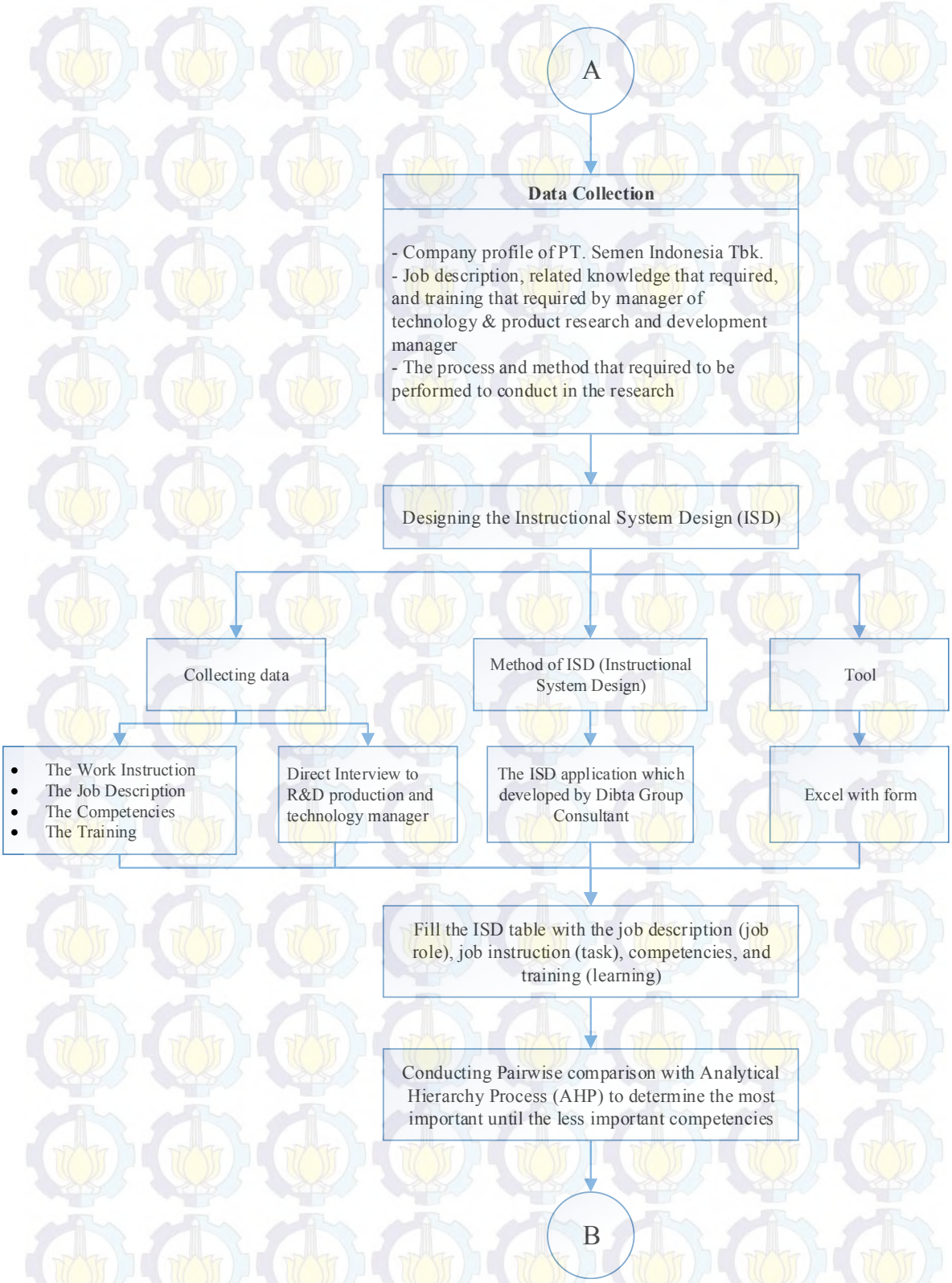

Figure 3. 2 Flowchart Methodology (Con't)

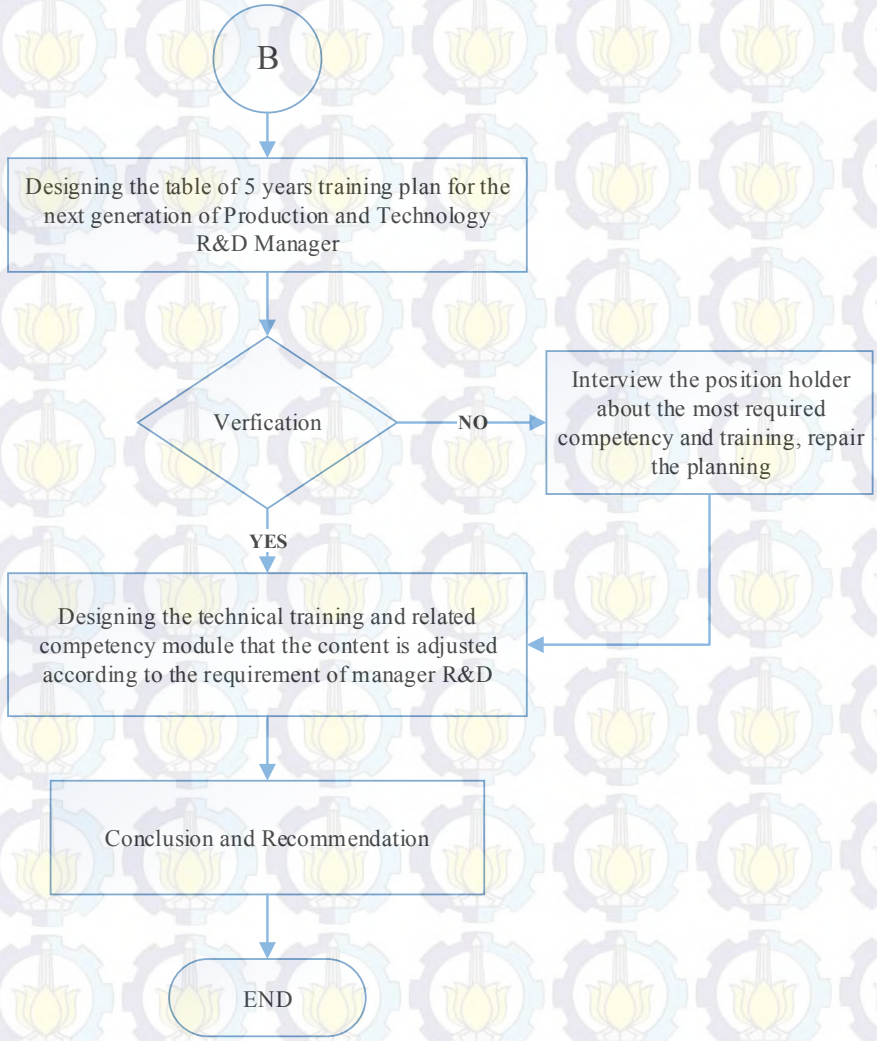

Figure 3. 3 Flowchart Methodology (Con't)

3.2 Flowchart Explanation

Based on flowchart above, this research is performed by several phases, which are preparation that consists of brainstorming, literature study, direct observation, and data collecting, then conduct the data processing by performing several methods. The method that would be applied in this problem are Instructional System Design (ISD), Analytical Hierarchy Process (AHP), then planning and module content determination. The validation by interview to related position is conducted after determining the Analytical Hierarchy Process result. Then the last step is analysis and interpretation, conclusion and recommendation.

3.2.1 Brainstorming and data collection on PT. Semen Indonesia Tbk.

The first phase that will be performed is brainstorming and problem identification in the Semen Indonesia Tbk. The brainstorming process involves the author that mainly purposed to find the problem in particular sector which is technology and product research & development. Then the problem that founded is identified and relate it with the recent condition of region, Indonesia.

The next step in this phase is literature review. The literature review is conducted to understand the basic theories that being used by PT. Semen Indonesia Tbk., also the method or solver that can be applied in improving existing condition on PT. Semen Indonesia Tbk. The literature review that will be taken is about knowledge, knowledge management, knowledge management process, Quality Function Deployment (QFD), Analytical Hierarchy Process (AHP), and cement production process. Then direct observation that conducted on PT. Semen Indonesia is performed in several area of department, which are department of research and development, department of innovation, and department of human resource development. This step is performed to understand about the details of the departments, include the existing condition of the department.

The data collecting is performed to know about the data that related with the object and problem that will be solved. The description of company, company profile of PT. Semen Indonesia, job description of technology and product research & development, include the instruction, competencies, and training that required.

3.2.2 Designing the Instructional System Design (ISD)

This design of Instructional System Design (ISD) is originally invented by Edgar Dale in 1946 with a hierarchy of instructional methods. Then Dibta group consultant developed the method to be applied the method of ISD in 2013 on PT. Semen Indonesia Tbk. The process of designing the ISD is mainly purposed to arrange group of job description.

The ISD table consists of job intent, job function, job role, task, competencies, and learning. Each of them are filled with job description, job instruction, competencies/knowledge, and training. Job function is filled with 5 main composition of knowledge. Then job role is filled by job description, then task with instruction, competencies with knowledge, and learning with the training that related.

3.2.3 Determine the critical knowledge by applying Analytical Hierarchy Process (AHP)

The third phase is processing the ISD table result into Analytical Hierarchy Process. Before generate AHP, performing the job description that aligned into knowledge, and training must be fully filled. This method is basically used for comparing each training criterion, so the AHP is applied by only conducting pairwise comparison.

This application of house of knowledge is mainly purposed to determine, which one of competency that the most important one to that position. This information is important for the incumbent of the next position holder to be prepared enough to understanding the most critical competency that needed. This information also applied in the training that supposed to be given as the incumbent of technology and production research & development manager. The information from AHP is also useful for creating the 5 years planning scape, in order to validate the planning from the most important one into the less important training.

Then after the knowledge is determined, the detail information about the training and content is made, according to the result of interview to related position. This phase is purposed to create the most effective training with chosen important content. Then the module that can be the instruction of work is created to be a guidance of manager to perform their task.

3.2.4 Conclusion and Suggestion

This final phase will explain about the overall result of the research. Research conclusion is performed by answering the research objective. Then the

recommendation is created to improve the research in the future by giving the advice to this research stakeholder, can be the authors, the direction future research, or the improvement on the process.

CHAPTER 4
DATA COLLECTING AND PROCESSING

This chapter contains the 2 main purposes: data collecting and data processing. Data collecting contains the information that obtained by observing the object. Then the data that already collected is processed as the input for data processing phase. Data processing has to be performed to answer the objective research.

4.1 Semen Indonesia's Company Profile

This subchapter describes about PT. Semen Indonesia, started with the history and overview of company, vision and mission, plants, and the organizational structure that related with the observation requirement.

4.1.1 History and Overview of the Company

PT. Semen Indonesia which previously well known as PT. Semen Gresik is manufacturing company that mainly run on cement production company. PT. Semen Gresik Tbk. was built on March 25 1953 with 2.000.000.000 rupiahs investment and inaugurated in Gresik, August 7 1957 by Ir. Soekarno with installed capacity of 250.000 tons of cement per year.

On July 8, 1991 Semen Gresik shares listed on the Indonesia Stock Exchange and is the first state-owned enterprises to go public by selling 40 million shares to the public. Composition of shareholders at the time: RI State 73% and the public 27%.

In September 1995, the Company made a Limited Public Offering I (Right Issue I), which alter the composition of ownership to the State 65% and the public 35%. On 15 September 1995 PT Semen Gresik consolidate with PT Semen Padang and PT Semen Tonasa. The total installed capacity the company at that time up to 8.5 million tons of cement per year.

In April 2012, the Company successfully completed the construction of Tuban IV plant with a capacity of 2.5 million tons. After a period of commissioning, in July 2012 the new plant was handed over, followed by the inauguration of

commercial operations in October 2012. Furthermore, in the third quarter of 2012, the Company also successfully completed the construction of a cement plant in Sulawesi Tonasa V. The new plant with a capacity of 2.5 million tons is undergoing a period of commissioning since September 2012, and is targeted to begin commercial operation in the first quarter of 2013.

On December 18, 2012 the Company officially took over 70% ownership of Thang Long Cement Joint Stock Company (TLCC) of Hanoi General Export-Import Joint Stock Company (GELEXIMCO) in Vietnam, with a capacity of 2.3 million tons. This corporate action makes SOE Multinational Company recorded as the first in Indonesia. With the acquisition of the TLCC, until the end of 2012, the design capacity of the Company amounted to 28.5 million tons (26.2 million tons in Indonesia and 2.3 million tons in Vietnam) of cement per year.

On December 20, 2012 PT. Semen Gresik Indonesia is changed into PT. Semen Indonesia due to the adjustment of strategic planning of forming Holding company to cover the government cement company. Government cement company which covered by PT. Semen Indonesia are PT. Semen Padang, PT. Semen Tonasa, PT. Semen Gresik, and latest one is PT. Thanglong Cement that located in Vietnam.

On December 20, 2013 the Company signed a deed of establishment of a joint venture company PT Krakatau Semen Indonesia (KSI), which will build a waste processing plant in the form of slag powder as a raw material for making cement.

Furthermore, on December 24, 2013, the Company continued the process of transformation of the Corporation and strengthen the role of Strategic Holding function by establishing a new subsidiary PT Semen Gresik.

In 2014 the Company continued business development program to begin construction of two cement plants in Padang and Apex and strengthen information technology support by establishing a subsidiary of PT. Semen Indonesia Synergy Informatics.

4.1.2 Company's vision and mission

Vision:

To be the leading cement manufacturing company in South East Asia

Mission:

- Developing the cement business and related industry company based on customer satisfaction
- Realizing an international standard company with competitive advantages and synergies to increase the added value on an ongoing basis
- Realizing social responsibility and environmentally friendly
- Giving the best achievement to all the stakeholders
- Building the competition through human resource development

4.1.3 Business Structure and affiliation

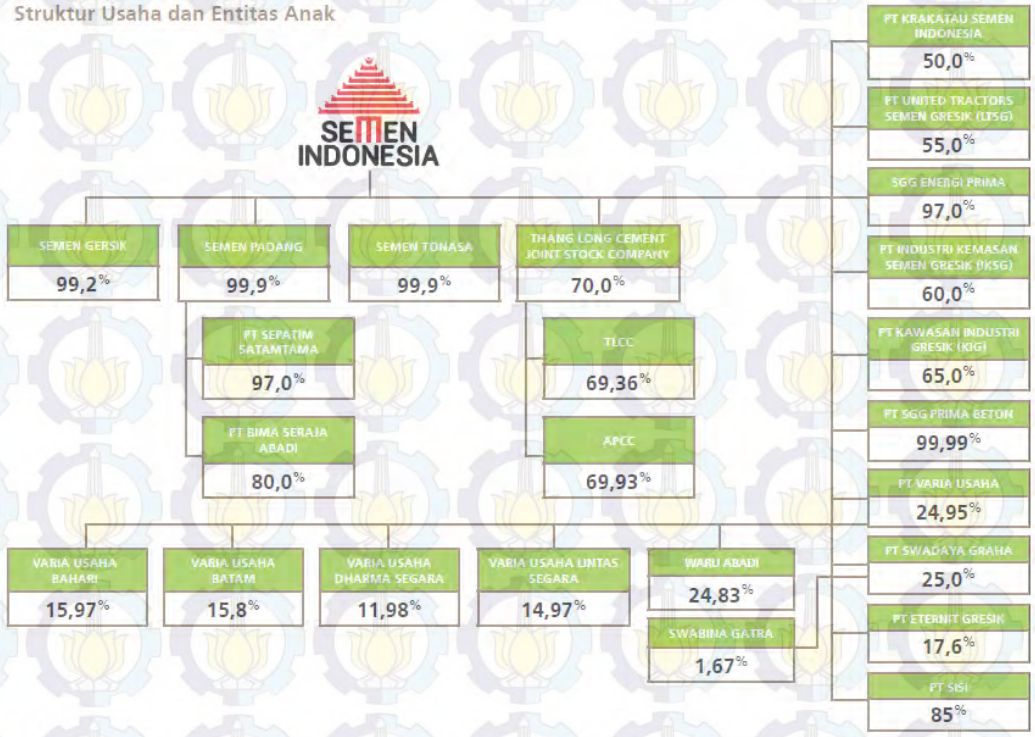

Figure 4. 1 Business Structure of PT. Semen Indonesia Tbk (Source: Annual Report of PT. Semen Indonesia Tbk.)

Table 4. 1 Subsidiary and affiliation of PT. Semen Indonesia Tbk.

No.	Company	Activities
1	PT. Semen Padang	Cement Production
2	PT. Semen Gresik	Cement Production
3	PT. Semen Tonasa	Cement Production
4	PT. Thang Long Joint Stock Company	Cement Production
5	An Phu Cement Joint Stock Company	Cement Production
6	PT. SGG Energy Prima (SEP)	Mining, trading, and coal distribution
7	PT. SGG Prima Beton (SPB)	Ready used concrete production
8	PT. United Tractors Semen Gresik	Mine material exploration and exploitation
9	PT. Industri Kemasan Semen Gresik	Main material for packing process
10	PT. Kawasan Industri Gresik	Industrial property market and building rental
11	PT. Swadaya Graha	Developer, Contractors, repair shop, manufacture, heavy machinery
12	PT. Varia Usaha	Distribution, trading, import and export
13	PT. Eternit Gresik	Fiber-cement slice production
14	PT. Varia Usaha Beton	Concrete industry and building material production
15	PT. Waru Abadi	Building material building, distribution and market
16	PT. Varia Usaha Bahari	Supply chain on shipping, renting heavy machinery

(Source Annual Report of PT. Semen Indonesia)

4.1.4 Organizational of R&D Department, HRD Department, and Project Engineering Department

Basically for the organizational structure in PT. Semen Indonesia is quite big, knowing that, in 2014 the organizational structure for Operating Company (PT. Semen Gresik) still covered by PT. Semen Indonesia Tbk. So the big organizational structure which covers managerial and production company structure, is cropped into 3 departments that related with this final project observation.

The organizational structure of PT. Semen Indonesia is shown in figure 4.4 below:

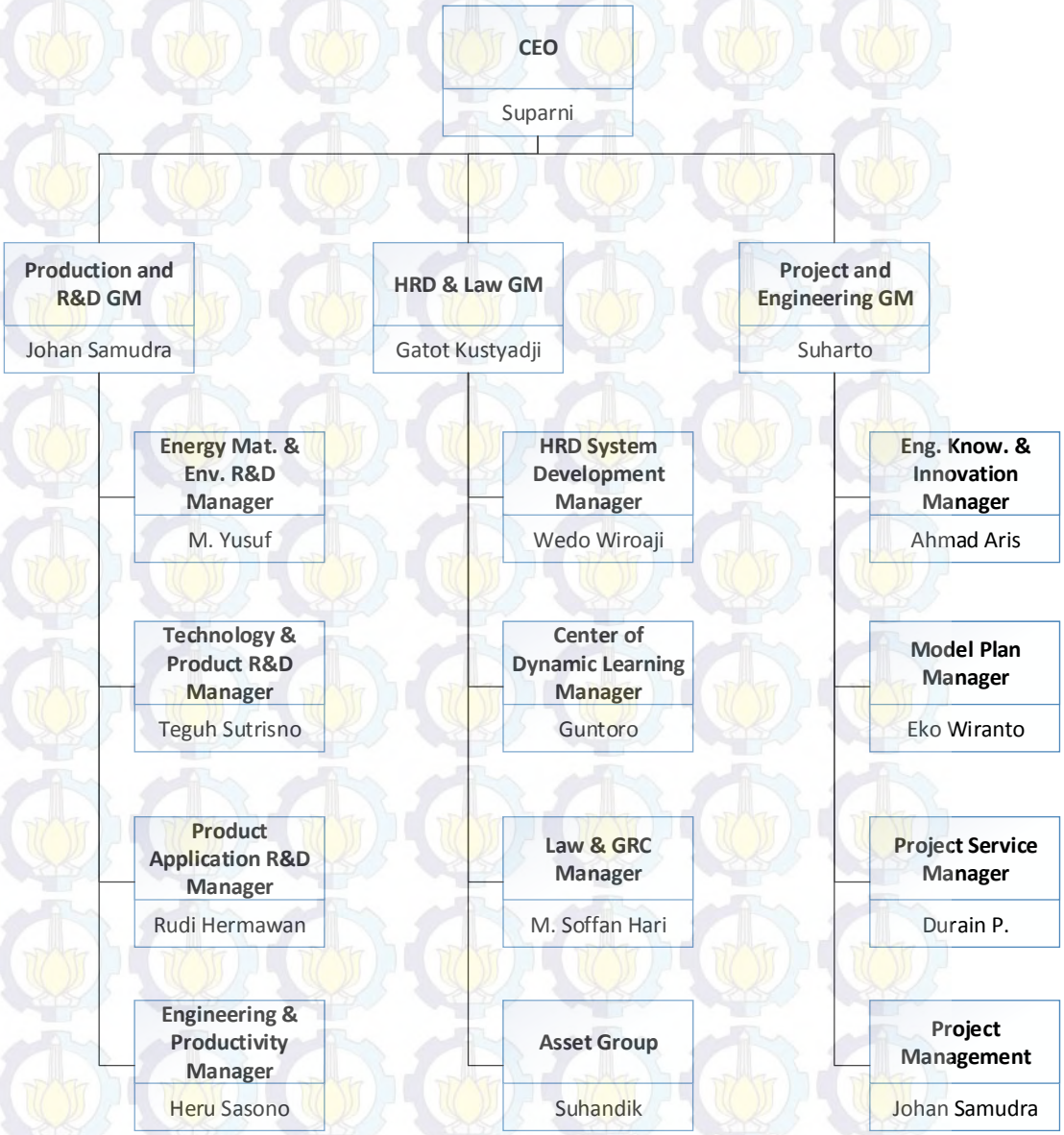

Figure 4. 2 Organizational Structure of R&D, HRD, and Project Engineering Department of PT. Semen Indonesia Tbk. (Source: Annual Report of PT. Semen Indonesia)

In figure 4.2 can be seen the organizational structure that exist in PT. Semen Indonesia. The main leader is CEO that currently held by Mr. Suparni, and the department is divided based on the function. In this report, the department that

shown only 3 departments which are Research & Development, HRD & Law, and Project & Engineering.

4.2 Unit Determination

Based on the fact that explained in the previous chapter, that the approach that supposed to develop from the internal point of view. The background shows that:

1. The development in product and technology must be applied in PT. Semen Indonesia Tbk.
2. The department that closely related with the product and technology development is technology & product R&D department
3. The specific information about position and department is required

4.2.1 Technology & Product R&D Department

Here is the explanation about the Technology & Product R&D Department that related with the purpose of department, organizational structure of department, and another information related with the position.

The department of Research and Development (R&D) in PT. Semen Indonesia Tbk is basically divided into 4 sector, according to the purpose:

- Energy material & environment R&D which the research is related with the new or better energy resource for the machine, also linked with the achievement in less environment impact
- Technology & product R&D which the research is to obtain the better process and product of cement. The process is obtained by improving the efficiency, and the product is obtained by creating something new in the product
- Product application R&D which the research is to obtain the better mixing and composition of the cement, by modifying the existing composition of cement. The approach of the result of mixing depends on the problem that supposed to be solved, and
- Engineering & productivity which the research is related with the method of engineering and productivity that supposed to be applied.

Since the approach of this report tends to the innovation of technology and product, so the detail information would be related with the technology & product R&D. The determination of technology & product due to the sector that closely related with the point that going to achieved in this report. So the organizational structure that going to be shown below is only consisted of technology & product R&D.

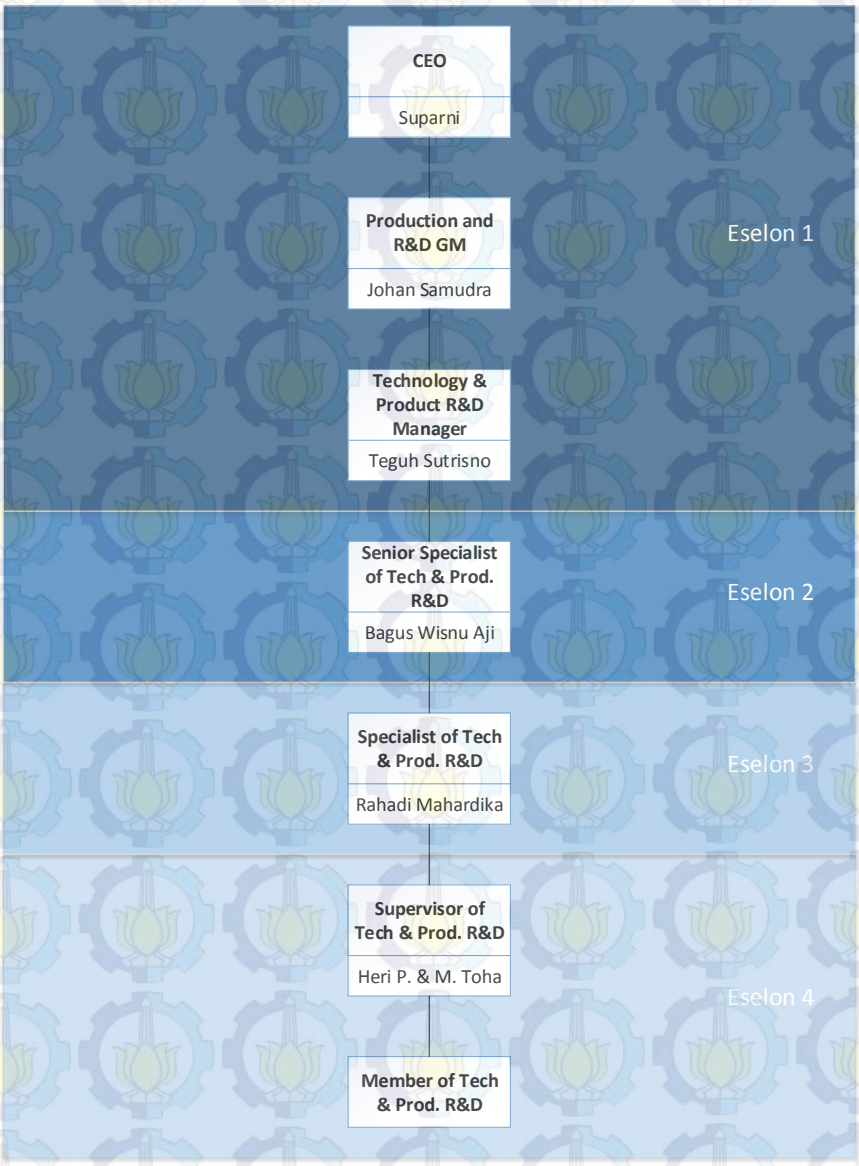

Figure 4. 3 Organizational Structure for Technology & Product RD Department

Figure 4.3 shown the organizational structure of Technology & Production Department and the current position holder. Also in the policy of PT. Semen Indonesia itself, there is a differentiation for position that divided into 5 level of eselon. Eselon has function as general leveling that can be used to determine the compensation determination. The function also related with the responsibility that held by smaller eselon, so does the point of view on problem solving.

So for the 1st eselon which has greater responsibility in department are held by CEO, Production and RD GM, and Technology & Production RD manager. Then for the 2nd eselon is held by Senior Specialist that consists of only one person in charge. Then for the 3rd eselon is held by Specialist which currently held by Mr. Rahadi Mahardika. Then for the 4th eselon consist of 2 positions, Supervisor and the member of technology & production RD department. For R&D department there's no 5th eselon because there are no operators that working by interacting directly with machine or working on the factory like the other department does.

Then for the knowledge that required that differentiate the level of eselon is shown in the table 4.2 below

Table 4. 2 Learning Intense and Learning Solution of Production Department by Eselon Level

Attendance	Leaning Intense	Learning Solutions
All Eselon		High Voltage Training; Autonomus TPM & RCM; Maintenance Transformator; Claudius Peters; Packer System
Eselon 1 / Eselon 2 / Eselon 3	Leadership training related to requirement of work organization	Leadership Program
Eselon 2	Understand and manage the risks inherent in each business unit associated with work productivity	Risk Management
Eselon 3	Capable on finding new alternative sources of raw materials, manufacturing feasibility analysis and the technical usage	Maintenance Management; Research Process; Innovation Process
	Knowledge of financial for production department	Alternative Material Managerment; FINON; OLDP
	Arrange, socialize, and ensure the maintenance management system performance	
Eselon 4 / Eselon 5	Maintenance of belt Conveyor, bucket elevator, chain conveyor, airslide, etc	Material Transporter Maintenance; Vertical Cement Mill; Safety Behavior
	knowing about the selection, design, and maintenance of bearings and maintenance	Bearing Maintenance; Horizontal Cement Mill; SAP Operation
	Forming a good teamwork between employees	
	Capable on analyzing the problem which covers fan, blower, and compressor problem solving	Outbound Management Trainee; Cement Mill Optimization; ISO 9001:2008
	Make safety as a necessity and habits in daily activities at work	
	Capable on performing maintenance according to preventive and predictive scheduling	Fan, Blower, and Compressor; Predictive and Preventive Maintenance; ISO 14001:2004
	User is able to create planning for work and troubleshooting ACS800	
	Knowing the basic operation of Vertical Cement Mill and Maintenance VCM	SMK-3; Advanced AVV ACS 800; OHSAS 18001:2007
	Capable on using SAP as needed	
Eselon 4	Capable on english communication	English Course; Maintenance Planning Control; Maintenance Sparepart
	Capable on understanding OSH policy and its environmental impact	
	Capable on planning the number and spare part that needed	AC/DC Motor Drive
	Performing planning and controlling on maintenance activity	Occupational Safety and Health (OSH) & Environment
	User is able to create planning for work and troubleshooting Motor Drive AC and DC	
	User is able to create planning for work and troubleshooting Switchgear ABB	Advanced Switchgear ABB
Eselon 5	Use is able to create planning for work and troubleshooting CCR Station Operator	VI-Card Control; HMI FTView; Measurement Tool Calibration
	Use is able to create planning for work and troubleshooting Control Proportional Solenoid hydraulic cooler	
	Use is able to create planning for work and troubleshooting DCS800	Advanced DCS 800; Welding
	Understand how to measurement tool and how to calibrate the tool	
	Capable on performing welding according to basic instruction	

Then, by considering the sector and eselon that shown in the data above, the author subjectively choose technology & production RD due to the innovation that needed to improve the quality of market share is located in the technology that used and the process of cement production itself. Also for the chosen level of eselon that observed would be 3rd eselon due to the balance requirement of training point of view. The balance requirement refers to the technical and managerial ability of problem solving that held by 3rd eselon is related with the objective to improve innovation quality and quantity in PT. Semen Indonesia Tbk. The detailed information about position would be shown in the next sub chapter.

4.2.2 Specialist of Technology & Product R&D

Here is the explanation about the Technology & Product R&D Department that related with the purpose of department, organizational structure of department, and another information related with the position.

Specialist of Technology & Product R&D which leads by Senior Specialist of R&D is purposely made in order to identify, analyze, arrange, initiate, perform, coordinate, and evaluate the research and development activity around technology, product and quality assurance sector. The sector also includes testing, scale up, trial, pilot project, program implementation, policy implementation, and quality standard determination under the Senior Specialist' supervision with regulation and current condition of Operational Company (OPCO) consideration. These activity is conducted in order to create efficient and environmentally friendly technology of cement production process, create cement product that fit with customer demand, and quality fulfillment according to the strategic policy that assigned by company. Also to build the Center of Research in technology and product sector in order to achieve World Class of CoR as Center of Excellence according to the Semen Indonesia Center of the Champs (SICC) vision.

The Job description that given to specialist of Technology & Product RD are:

1. Arrange and propose a work plan of research and development in the field of technology and products
2. Implementing and managing research and development activities in accordance with the work plan established department includes testing (laboratory analysis), scale up, and pilot project
3. Creates research that can be implemented at the plant on the basis of the approval of the board of directors (workable)
4. Implement and coordinate the results of technological research and products have been approved by the directors at each operating company (OPCO)
5. Monitoring and evaluating the results of technological research and products have been implemented

6. Build partnerships with external parties (academia, private sector, government, etc.) in the sector of development research
7. Manage and monitor the progress of cement products, science, technology, processes, and best practices for adoption cement
8. Develop policies quality assurance system that includes quality standards of materials , processes and products in the group
9. Collect, evaluate and report on data quality teachers if in accordance with the policy of quality assurance systems that have been established
10. Arrange and propose a program of work center of research in fields of technology and products and play an active role in building research center (Center of Research) through the development and improvement of research facilities (infrastructure), human resources (people), and strengthening of the organization (process)
11. Monitoring and reporting the implementation of CDM project in Tuban plant and Semen Tonasa related to data management, external verification and issuance of CERs

The making of the job description for each position basically aim to specify the purpose of the post was made, so it can be matched with the vision and mission of the company. In addition, the functions of the job description is to reduce ambiguity between the existing positions in the company. Furthermore, of course, to control the effectiveness of the post, made the output of the details of each job description. The output that wanted to be achieved for this position are:

1. Work program of research and development of technology and products
2. Implementation of the research in accordance with a predetermined plan
3. The research results that can be implemented in the Indonesian cement group
4. Successful implementation of research results
5. Optimizing the implementation of research results in the context of efficiency and environmentally friendly
6. Capacity building and transfer knowledge for increased competence of human resources

7. Update the development of technology and products to be implemented into the work plan
8. Standard quality of materials, processes, and products that must be implemented by each Operating Company
9. Successful in fulfilling joint quality requirement
10. Center of Research work program which will be implemented in order to obtain the World Class Center of Research
11. Successful in CER (Certified Emission Reduction) certification

4.2.3 Comparison between Specialist of Technology & Product RD and Supervisor/Junior Technology & Product RD

Based on the assumption that the turnover between each position between RD department's employees, the only employee that is projected into specialist of RD is supervisor/junior RD which has lower position in 4th eselon. The supervisor/junior RD which currently held by 2 employees has several job description that align to the department's goal. This subchapter is basically shown the gap between these 2 positions by comparing the job description. Then the difference in scope of work and knowledge of both employees would be appeared by comparing the job description. The comparison of job descriptions between Specialist RD and Supervisor RD are:

Table 4. 3 Job Description Comparison between Specialist and Supervisor RD

Specialist of Technology & Product RD	Supervisor/Junior Technology & Product RD
Arranging and proposing a work plan of research and development in the sector of technology and products	Support the planning of research and development in the sector of technology and products
Implementing and managing research and development activities in accordance with the established department work plan includes testing (laboratory analysis), scale up, and pilot project	Implementing research and development activities in accordance to established department work plan
Creating research that can be implemented at the plant on the basis of the approval of the board of directors (workable)	Creating research that can be implemented at the plant on the basis of the approval of the board of directors (workable)
Implementing and coordinating the results of technological research and products have been approved by the directors at each operating company (OPCO)	Operating the laboratory equipment to perform the research

Table 4. 4 Con't Job Description Comparison between Specialist and Supervisor RD

Specialist of Technology & Product RD	Supervisor/Junior Technology & Product RD
Monitoring and evaluating the results of technological research and products have been implemented	
Building partnerships with external parties (academia, private sector, government, etc.) in the sector of development research	
Managing and monitoring the progress of cement products, technology, processes, and best practices to be adopted	Managing and monitoring the progress of cement products, technology, processes, and best practices to be adopted
Developing quality assurance system policy that includes quality standards of materials , processes and products in the group	
Collecting, evaluating and reporting on group quality data whether it is appropriate with the policy of quality assurance systems that have been established	Collecting the material, process, and group product data whether it is appropriate with the policy of quality assurance systems that have been established
Arranging and proposing a program of work center of research in fields of technology and products and play an active role in building research center (Center of Research) through the development and improvement of research facilities (infrastructure), human resources (people), and strengthening of the organization (process)	
Monitoring and reporting the implementation of CDM project in Tuban plant and Semen Tonasa related to data management, external verification and issuance of CERs	Monitoring and reporting the implementation of CDM project in Tuban plant and Semen Tonasa related to data management, external verification and issuance of CERs

Based on the table 4.3 and 4.4 above can be seen the difference of organizing scope from both positions. The difference on job description also affects the knowledge requirement and job specification of both positions. It can be seen from the 1st job description of specialist that shown the arranging and coordinating scope, but for the supervisor job description shows the supporting scope which the responsibility is lower even the target is similar, to plan the research and development in technology and product. The 2nd job description also shows the same result which the specialist tends to implement and managing research while the supervisor's responsibility is just implementing the research.

The difference in job description's scope shows that there's a gap between knowledge of technical and managerial in both of them. These facts also show that the adjustment for supervisor who wants to achieve higher position is needed by performing training.

4.3 Designing Instructional System Design

Instructional System Design is basically the development application of knowledge management that created to get the basic information of detailed information about position or else. But in this final project, the Instructional System Design that conducted is already adjusted to be appropriate for identifying the information of knowledge and training.

The steps that must be performed to conduct this Instructional System Design method are:

1. Create the Instructional System Design (ISD) table

Table 4. 5 Instructional System Design (ISD) Form

Job Intent	Job Function	Job Role	Task	Competency	Learning
	Manage Proses				
	Utilize Resource				
	Inspiring People				
	Networking partner				
	Personal Mastery				

2. Interview the particular position to obtain the information about the job description that given by company, then fill it on job role.
3. Interview the particular position to obtain the information about work instruction. Connect the work instruction with the job role to be filled in task.
4. Interview the particular position to obtain the basic competencies of the position, then connect with the task to be filled in the competency
5. Then the last is sort the archive of training to be connected with the competency that required by the position, then filled it in learning columns.

Then the result for Instructional System Design for Specialist of Technology & Product RD PT. Semen Indonesia Tbk are shown in the table 4.4 until table 4.7 below:

Table 4. 6 Instructional System Design Table Result for Specialist of Technology & Product RD

Position	Manager/Specialist Technology & Product Research Development
Eselon	3
Current user	Rahadi Mahardika, ST.

Job Intent	Job Function	Job Role	Task	Competency	Learning
	Manage Proses	Arranging and proposing a work plan of research and development in the field of technology and products	Arranging research planning from member's innovation	Research Management	Research Process
			Proposing innovation idea as improvement or new product	Innovation Management	Innovation Process
		Implementing and managing research and development activities in accordance with the established department work plan includes testing (laboratory analysis), scale up, and pilot project	Managing research activity which already arranged	Technical of Laboratory	Internal Auditor Integrated Management System (ISO 9001:2008, ISO 14001:2004)
			Creating research report from research activity	Creating Report of sampling and research	Research Process
			Preparing sample for research material	Sample Preparation & Analysis method	Research Process
		Monitoring and evaluating the results of technological research and products have been implemented	Monitoring the implementation result of research by product sampling	Sampling method	Research Process
			Communicating research results that have been implemented or that need to be made with marketing and production department	Customer needs identification	Inter-department communication

Table 4. 7 Con't Instructional System Design Result for Specialist of Technology & Product RD

Job Intent	Job Function	Job Role	Task	Competency	Learning
	Manage Proses	Managing and monitoring the progress of cement products, technology, processes, and best practices to be adopted	Monitoring the mass and heat balance technology development	Mass balance & heat balance calculation on cement production process	Mass and heat balance Training
			Monitoring the technology development on chemical and additive material for cement	Material/chemical as additif on cement formulation	Chemical and physical of cement composition training
			Monitoring the cement product development and technology on market	Cement identification and latest cement technology	Chemical and physical of cement composition training
			Monitoring the technology development on energy conservation and green industry for cement	Energy Conservation and Green Industry on PT. Semen Indonesia	Efficiency program and energy conservation of cement production training
			Monitoring the technology development on kinetic reaction and thermodynamic	Kinetic reaction and thermodynamic calculation	Basic Thermography
			Monitoring the technology development on factory equipment (Fan, compressor, utility, kiln, and etc)	Knowledge of factory equipment unit (Fan, Compressor, Utility, Kiln,)	Raw mill, kiln, coal mill, finish mill basic training
		Developing quality assurance system policy that includes quality standards of materials , processes and products in the group	Arranging quality assurance system policy according to the policy that established on ISO 9001	Quality management system competency, Environmental Management System, and Laboratory Management System	Technical of Laboratory
			Arranging quality assurance system according to the material and implemented processes	Knowledge about material and additif that commonly used in cement production process	Chemical and physical of cement composition training

Table 4. 8 Con't Instructional System Design Result for Specialist of Technology & Product RD

Job Intent	Job Function	Job Role	Task	Competency	Learning
	Manage Process	Collecting, evaluating and reporting on group quality data whether it is appropriate with the policy of quality assurance systems that have been established	Measuring the measurement tool's accuracy by performing calibration to maintain the product assurance	Calibrating forinstrumentation's measurement and sampling tool	Calibration Mass, Temperature, and Pressire
			Collecting and evaluating the data of cement product quality	Analyzing and evaluating the cement quality	Technical of Laboratory
			Evaluating the product quality according to the policy that established on ISO 9001	Quality management system, Environmental Management System, and Laboratory Management System	Internal Auditor Integrated Management System
		Arranging and proposing a program of work center of research in fields of technology and products and play an active role in building research center (Center of Research) through the development and improvement of research facilities (infrastructure), human resources (people), and strengthening of the organization	Arranging the research planning by considering the usage of infrastructure, people, and process	Statistical by performing Design of Experiment (DOE)	Research Process
		Monitoring and reporting the implementation of CDM project in Tuban plant and Semen Tonasa related to data management, external verification and issuance of CERs	Collecting the historical data related to previous factory progress as the consideration	Managing and controlling the research archieve	Research Process
			Monitoring and reporting the current condition of Tuban factory and Semen Tonasa	Collecting and processing the data	Research Process

Table 4. 9 Con't Instructional System Design Result for Specialist of Technology & Product RD

Job Intent	Job Function	Job Role	Task	Competency	Learning
	Utilize Resource	Implementing and coordinating the results of technological research and products have been approved by the directors at each operating company (OPCO)	Implementing and monitoring the research that has been approved include the planning	Research Management	Research Process
	Inspiring People		Coaching		OLDP
			TNA		TNA training
	Networking partner	Building partnerships with external parties (academia, private sector, government, etc.) in the sector of development research	Arranging proposal & proposal presentation	Presentation and communication method	Presentation Skill
			Is able to communicate with external parties, either Indonesian or foreigner	English course	Communicative English Project (CEP) An English Training for International Convention
	Personal Mastery	Creating research that can be implemented at the plant on the basis of the approval of the board of directors (workable)	Creating the product design or machine layout that can be implemented	Operating software AutoCAD 3D	Software training (CFD, AutoCAD, dan Solid Works)
			Making the machine design that can be implemented	Operating software CFD (Computational Fluid Dynamics) and Solid Works	
			Proposing innovation idea that can be as improvement of existing product or new product	Innovation Management	Research Process

4.4 Conducting Analytical Hierarchy Process (AHP)

The required training that informed by previous step which is Instructional System Design is processed to obtain the useful information for particular position. AHP is one process that can subjectively determine the importance level of particular criteria. The AHP calculation is conducted by using software named Expert Choice. In this case, required training for specialist of RD department would be the criteria of AHP calculation. This software is one of AHP application software that covers only pairwise comparison of AHP calculation.

The training result from ISD result is grouped into several group. The grouping depends on the content of the training. After grouping is conducted subjectively, the core training consists of 7 training, which are research process (proses penelitian), innovation proses (proses inovasi), OLDP, Raw Mill, Chemical & Physical Training, efficiency program, and technical laboratory training. Then each training is compared by the level tendencies of 1-9, and the result is:

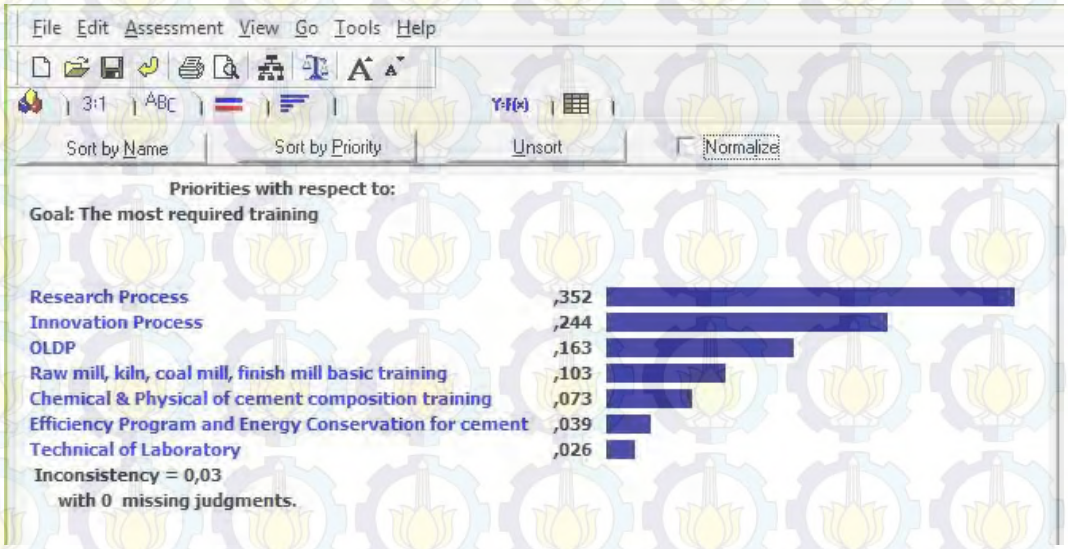

Figure 4. 4 Expert Choice Total Result

Then the rest is compared by the part of another training, that shown in figure 4.8 below:

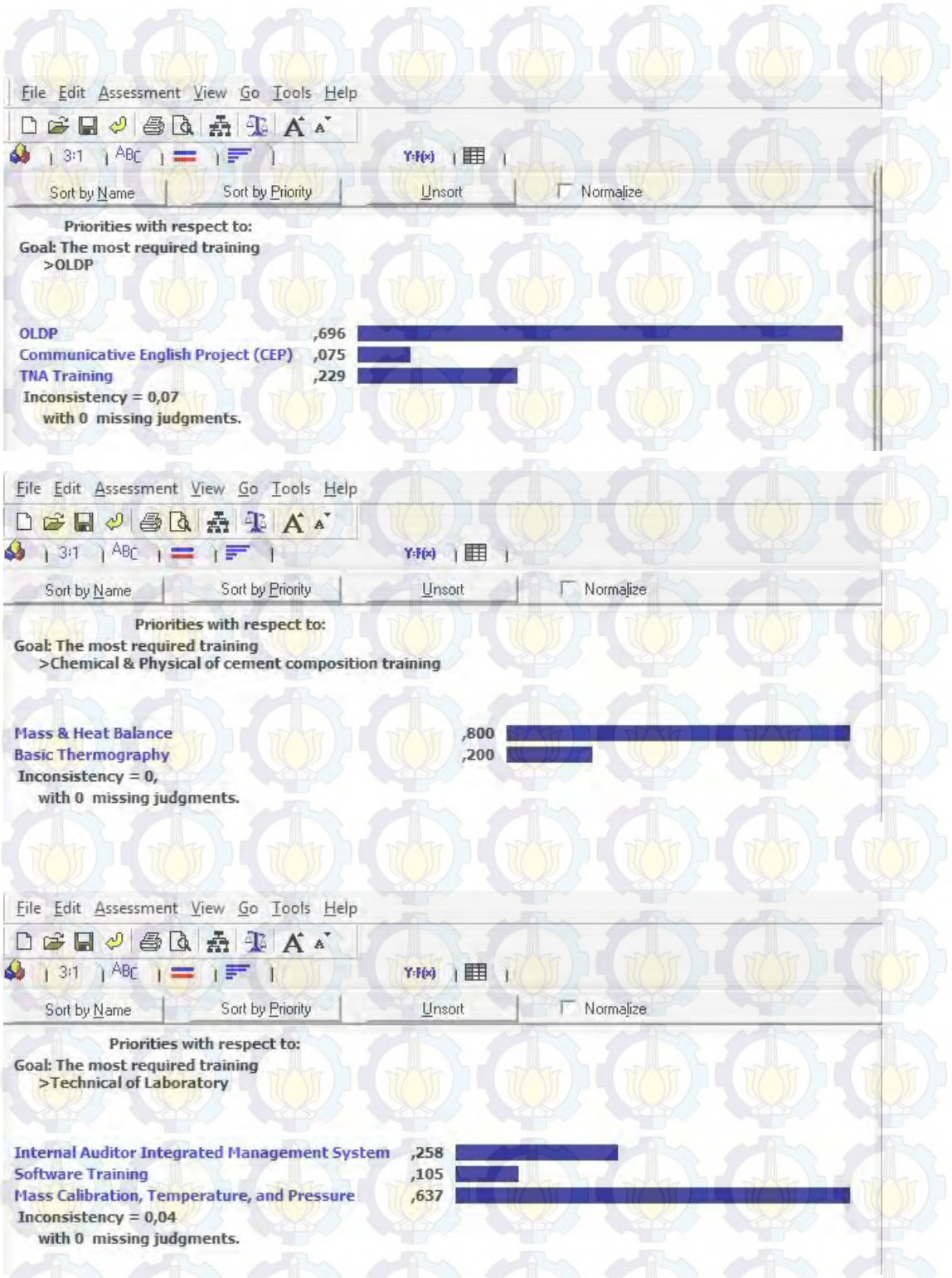

Figure 4. 5 The result of Expert Choice by Grouping for OLDP, Chemical & Physical Training, and Technical Laboratory

The figure shows for OLDP training consists of OLDP which the approach is managerial skill, Communicative English Project, and TNA training for performance measurement. Then for Chemical & Physical that basically learn about theory of cement consists of Mass & Heat Balance and basic thermography. The last is Technical laboratory that learn about how to be a laboratory assistant consists of internal auditor that learn about ISO, Software training that learn about AutoCAD or design, and Mass Calibration & Pressure.

The figure above also shows the result of AHP calculation by using Expert Choice software. It shows the criteria and the degree of importance of criteria. The result shows that the most important training that supposed to be taken by specialist is Proses Penelitian training, then Proses Inovasi, and OLDP. This result also proves that the most important training for specialist is Proses Penelitian training, then the module and technical training specification of this training must be designed.

4.5 Designing the Specialist of Technology & Product Training Plan

The previous AHP process that only covers the pairwise comparison result shows the most important training until the less one. In this subchapter, the result of previous steps are processed into 5 years training plan by arranging the group of training by the pairwise comparison's degree of importance level. The determination of group is determined by the consideration of standard training requirement of the employee and the result of direct interview. The first year of training plan is chosen by the highest importance degree and lower importance degree till the 40 hours/year standard training requirement duration is fulfilled. Then the rest of second until fifth year is following the step of first year group determination.

So the training that supposed to be taken by the next specialist technology and production R&D position holder are:

Table 4. 10 The 5 years training plan for specialist of technology & production R&D Department

Year 1	Year 2	Year 3	Year 4	Year 5
				TNA training
			Communicative English Project (CEP) An English Training for International Convention	Software training (CFD, AutoCAD, and Solid Works)
			Calibration Mass, Temperature, and Pressure	
		Efficiency program and energy conservation of cement production training	Internal Auditor Integrated Management System (ISO 9001:2008, ISO 14001:2004 & SMK-3, OHSAS 18001:2007)	
		Basic Thermography		
	Raw mill, kiln, coal mill, finish mill basic training	Technical of Laboratory		
	Chemical and physical of cement composition training			
Research Process	Mass and heat balance Training			
Innovation Process				
OLDP				

Basically in PT. Semen Indonesia, there is a policy that used for training. The standard training requirement that used are:

- Employees should at least freed their 40 hours for taking any training every year
- Training plan for a year is arranged personally by employee, but the determination of training that can be took is determined by higher manager
- Training that taken is subjectively chosen by employee in order to fulfill the policy of minimum 40 hours training per year.

From that information, can be determined the technical, the type of training, time needed to conduct training, the training that can be conducted for a year, etc.

The result of Expert Choice is divided into 5 years due to the standard of employee switching in PT. Semen Indonesia is commonly between 5 years of

position holding. Then for the 1st year, the training that the most important and required is scheduled which are research process (proses penelitian), innovation process (proses inovasi), and OLDP. Then the rest of years are determined as the 1st year following the Expert Choice's degree of importance ranking result. The schedule is made subjectively under the circumstance of employee's standard training requirement for PT. Semen Indonesia Tbk.

4.6 Designing the Technical Training and Module

In this sub chapter, the planning process is continued to designing the training and module for the most important training for Specialist Technology and Production RD position. Based on the previous sub-chapter which calculate the level of importance by conducting Analytical Hierarchy Process using Expert Choice, the result shows the most important training is Proses Penelitian. Proses Penelitian itself covers the knowledge related to idea brainstorming, creating proposal, performing research, managing research schedule, and reporting.

The table that shown all detailed information related with the training that given to particular position is shown on the table 4.9 below:

Table 4. 11 Research Process (Proses Penelitian) Training Design

Position	Manager/Specialist Technology & Product Research Development
Eselon	3
Current user	Rahadi Mahardika, ST.

Curriculum	Research Management
Curriculum Code	
Training	Research Process
Training Code	
Training Method	Workshop & Presentation
Duration	24 hours / 8 hours x 3 days
Proposed Position	Supervisor of technology & product research development
Responsibility of position	Able to perform basic research and application
	Able to identify and deliver the research implementation
	Able to choose which concept that can be implemented
	Able to prepare the budget estimation for developing, designing, producting, constructing, and operating
	Able to suggest new option for developing resource
	Able to designing the model to prove the technical and commercial feasibility
	Able to create and explain the report of reasearch
Training Content	How to generate ideas
	How to create research proposal
	How to manage the research schedulling
	How to conduct a reseach activity
	How to report the final result of research activity
Trainer	Consultant
	Rahadi Mahardika as Specialist of Technology and Production RD
	Bagus Wisnu Aji as Senior Specialist of Technology and Production RD
	Teguh Sutrisno as Technology and Production RD Manager

CHAPTER 5
DATA ANALYSIS AND INTERPRETATION

Chapter 5 conducted an analysis of decision has been taken in regard to complete this research. This analysis will be a fundamental reason for the decision taken in order to solve the problem happens in PT. Semen Indonesia Tbk.

5.1 Training Required by Specialist of Technology and Production RD

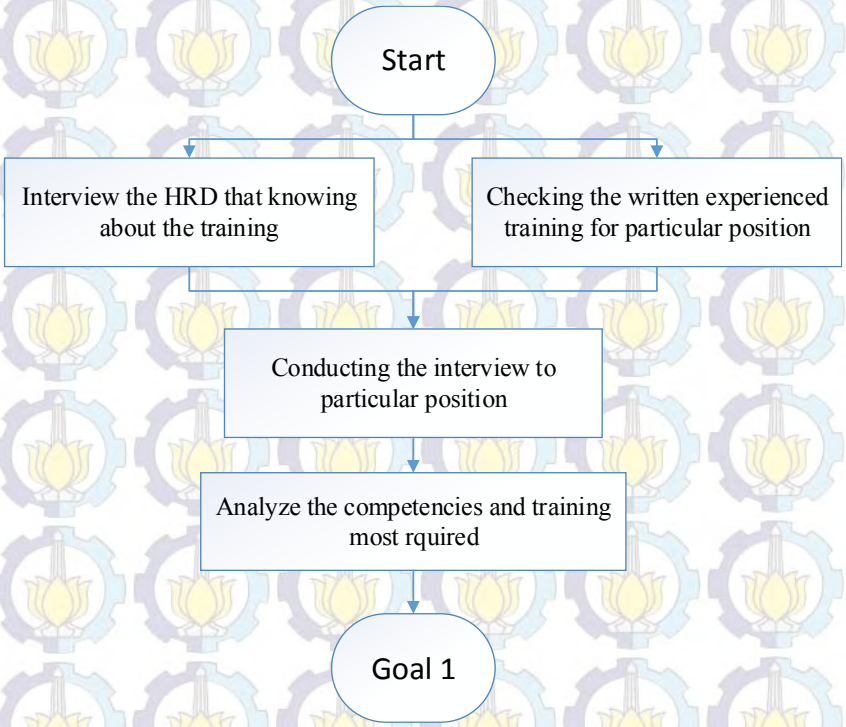

Figure 5. 1 Flowchart for 1st Objective

The basic of this subchapter is taken from the purpose and the methodology flowchart, then the combination is the flowchart of each purposes. The first objective is obtaining the data about training required for particular position that conducted by interviewing and checking the existing training data that already followed by previous holder.

By the explanation in Chapter 4, the position that being observed is determined subjectively by consideration of author's background point of view. The point of view that showing the requirement of increasing the number of innovation

to face the competition of cement product market share. Then the position that observed is the Specialist Technology & Product RD of PT. Semen Indonesia Tbk which currently held by Mr. Rahadi Mahardika, S.T.

Based on the information on Chapter 4, shown that RD department is divided into 5 eselons, which Mr. Rahadi as Specialist is placed on 3rd eselon. Each eselon is differentiated by the job description that for 3rd eselon tends to coordinate and perform the research activity. The research activity itself covers all the brainstorming/finding the idea, making proposal, performing research, making a research schedule, and reporting.

The previous chapter also showed the balance requirement of training point of view. The balance requirement refers to the technical and managerial ability of problem solving. It can be seen in the figure 4.4 about Learning Intense and Learning Solution that showing the 3rd eselon's basic training that required are Maintenance Management, Research Process (Proses Penelitian), Innovation Process (Proses Inovasi), FINON, OLDP, and Alternative Material Management. Maintenance management, alternative material management, Research Process, and Innovation Process are the training that contains both managerial and technical knowledge. Because manager can't specifically perform maintenance scheduling without knowing what kind of machine and the how these machines work. Also creating innovation can't be initiated without knowing the basic process of cement production. Then the other two FINON and OLDP tend to managerial training which covers how to create financial report and budgeting for FINON and leadership training for OLDP. These information are useful for the next objective that conducted by implementing Instructional System Design (ISD) method.

5.2 The Detail Knowledge Information by Conducting ISD

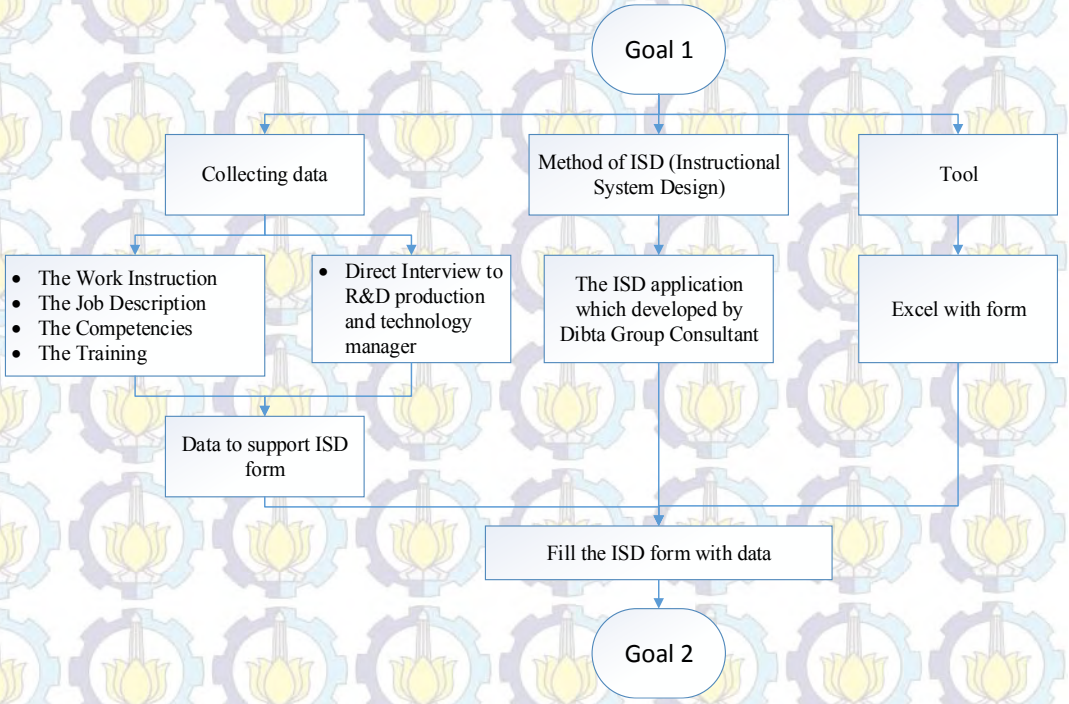

Figure 5. 2 Flowchart for 2nd Objective

Instructional System Design is a method that purposed to obtain detailed knowledge information that required by particular position. The process is simply conducted by collecting the data, knowing the basic method of ISD, and using tool as excel to perform this method. Collecting data can be conducted by identifying the work instruction, job description, competency, and training that furthermore implemented into ISD table as job role, task, competency, and learning. Then the method of ISD that developed by Dibta group consultant can be seen as table form in table 4.2 that put in chapter 4.

Then the Instructional System Design result for Specialist Technology and Production RD of PT. Semen Indonesia Tbk. can be seen in figure 4.5 that conducted by direct interview between particular position and HRD manager. The job description is divided into 5 to differentiate the function of job description and the training impact for company's output.

For the specialist technology & Product RD, the learning result that refer into the training required shows research process (proses penelitian), innovation process

(proses inovasi), mass & heat balance training, internal auditor integrated management training, chemical and physical of cement composition training, basic thermography training, technical laboratory training, mass calibration training, OLDP, software training, and english course training.

5.3 The 5 Years Training Plan for Specialist of RD Department

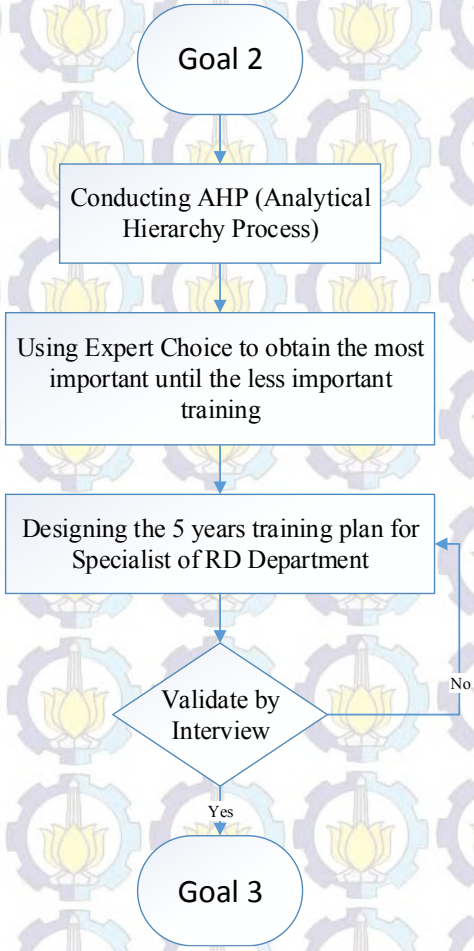

Figure 5. 3 Flowchart for 3rd Objective

Based on the result of previous sub chapter, the required training that resulted by conducting Instructional System Design (ISD) is used to conduct further process to determine which training is the most required and which one is less required. This process is conducted by applying Analytical Hierarchy Process (AHP) method to obtain the degree of importance for each training. The application of AHP is conducted by using Expert Choice software that can be seen in figure 4.7 for the

input of criterion and figure 4.8 for the degree of importance that resulted. The most importance is shown by the highest value its degree.

Known from the result of Expert Choice result that the most important training for Specialist Technology & Product RD department is research process (proses penelitian) that followed by innovation process (proses inovasi) and OLDP. The least important is software training that tends to upgrade the personal capability itself instead of support the company's achievement. Then the result of Expert Choice is formed into table of 5 years training plan for Specialist of RD department for the next position holder that can be seen in figure 4.9 in previous chapter.

It also shows that basically needs at least 5 years to clearly understand the basic knowledge as Specialist Technology & Production RD. With current training regulation and policy, the minimum 40 hours training per year would be effective if the training is scheduled based on the personal requirement. So the performance of RD department can be improved due to the basic knowledge is owned by position holder. It's more effective if the content of training is adjusted based on the personal requirement also that would be conducted in the next step.

5.4 The Training Design for the Most Important Required Training

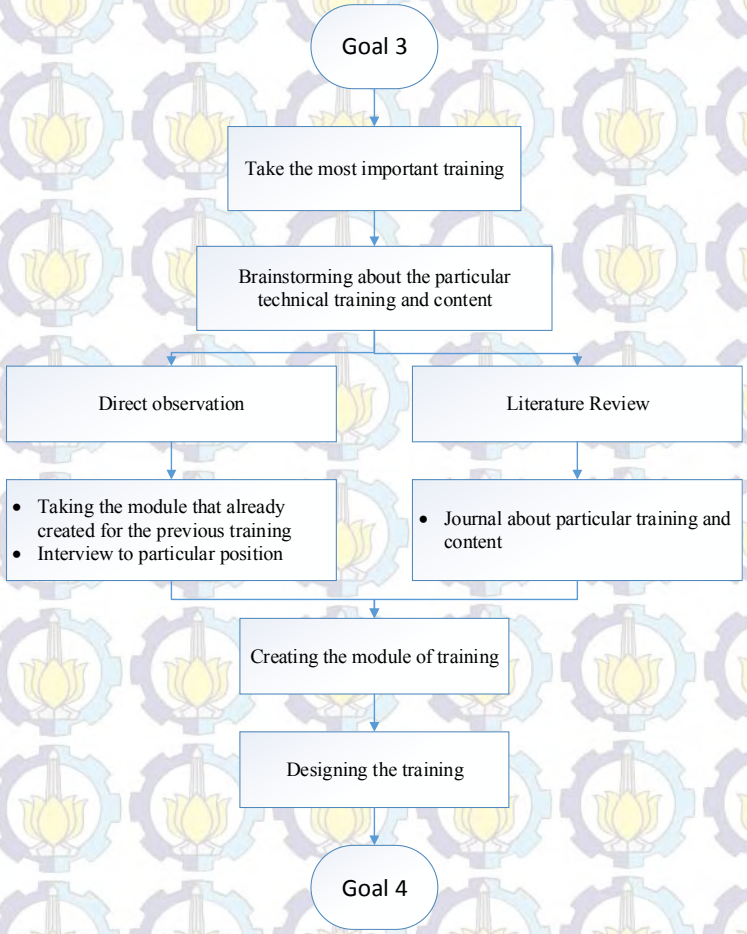

Figure 5. 4 Flowchart for 4th Objective

The training design is also based on previous sub chapter data which already explained that the most important training resulted is research process (proses penelitian). Then the chosen training is identified from both direct interview and literature review. Direct interview shows the content that required by Specialist technology and production RD that can be seen in figure 4.10 consist of:

- How to generate ideas
- How to create research proposal
- How to manage research schedule
- How to conduct research activity, and
- How to report the result of research activities.

Then the contents are developed into module by process of brainstorming and literature review that the module can be seen on figure 4.11. These module is quite useful for the next Specialist position holder due to the content that already adjusted with the needs of position holder itself.

CHAPTER 6
CONCLUSION AND RECOMMENDATION

This chapter include conclusion obtained from the analysis and interpretation which done in previous chapter. This chapter also provide recommendation for further research.

6.1 Conclusion

After conducting this research, there are several conclusion to be presented, which are:

1) The specialist technology and production RD department is the chosen position that determined through the fact that the innovation must be continuously increased to face the competition has several job description that commonly related with coordinating and performing research.
2) The training framework for Research and Development department by conducting Instructional System Design (ISD) is basically performed to obtain the detailed information about knowledge. The steps that have to be followed are determine the position, design the ISD, conduct AHP, design the 5 years training plan, and design the training that supposed to be held. The main output of Instructional System Design is the training list that connected from the position job description which are: research process, innovation process, OLDP, internal auditor, basic thermography, etc.
3) By conducting Instructional System Design (ISD) is known the detailed knowledge information about the specialist that appeared to be correlated each other from the job description, work instruction, competency, and its training. The job description is classified into several job function which is connected into task, competency, and the learning. Then the training that the most required based on the result of conducting AHP using Expert Choice is Research Process Training (pelatihan proses penelitian)
4) The content that the most required by Specialist of Technology and Production RD Department for Research Process Training consists of:
   - How to generate ideas

- How to create research proposal
- How to manage research schedule
- How to conduct research activity, and
- How to report the result of research activities.

6.2 Recommendation

The recommendation for this research is the needs of simulation and direct application for this theory of Instructional System Design (ISD) to ensure the improvement that expected by author is occurred.

The future research need to calculate the gap between the next position holder competency and the competency that need to be understood. Then the result can be applied into the candidate of next position holder to compare the feasibility of them to hold that new position.

For the future research, the financial budgeting by applying this method also need to be analyzed as the consideration for applying this method for every position in PT. Semen Indonesia Tbk. The analysis also can be implemented by applying another method such as training evaluation that consist of 5 level of training evaluation that ended up with Return of Training Investment (ROTI) calculation in the 5^{th} level.

Or else, it can be implemented by creating new department that focused on knowledge identification for whole company which involved every employee within company to ease the observation process.

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BIOGRAPHY

Antasena Davirga was born at Bogor, September 20th 1994 by their parents Mr. Heru Sudarsono and Mrs. Nurul Ainia. He mostly spent his study time on Malang city, started with getting through his elementary school in SDN Tunjung Sekar 1 in 2000-2006, then junior high school in SMP Negeri 5 Malang in 2006-2009, and senior high school in SMA Negeri 1 Malang in 2009-2011. The author joined the accelerated class program to shorten the senior high school's study duration into 2 years. Then in 2011, the author was accepted in Industrial Engineering of Institut Teknologi Sepuluh Nopember by invitation program.

During his study, the author was active in some activities, in 2nd year the author is active in AIESEC Surabaya by joining one of their project and becoming the committee. The committee learnt the author about responsibility and commitment, and also learnt about how to communicate in English with foreigner by joining AIESEC. In 3rd year the author is active in Program Kreativitas Mahasiswa (PKM) by creating the proposal related to community service. In this PKM program, the author also learnt about how to perform cooperation, which the further development of PKM Jamur involves cooperation between team and *Sego Njamoer*. The next program is Program Mahasiswa Wirausaha (PMW) that is applied as Kotak Jamur Portable and approved in 2014. Then also in 2014, the author joined in internship program with PT. Semen Indonesia Tbk. In the September 2014 the author was joined in student exchange program with UTeM Melaka Malaysia that brought the author into Malaysia to take the course there. Then the author was planned to graduates in March, 2016. For further information contact me by email: adavirga@gmail.com.